AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

(Autonomous)

(Approved by A.I.C.T.E., New Delhi & Permanently Affiliated to JNTU-GV, Vizianagaram)
NAAC Accredited with A+ grade
Tamaram (V), Makavarapalem, Narsipatnam (RD), Anakapalle Dist, Pin-531113

DEPARTMENT OF ECE- ELECTRONICS AND COMMUNICATION ENGINEERING

ACADEMIC REGULATIONS

COURSE STRUCTURE AND SYLLABUS

For PG-R24

M.Tech – DIGITAL ELECTRONICS AND COMMUNICATION SYSTEMS

(Applicable for batches admitted from 2024-2025)

AVANTHI INSTITUTE OF ENGINEERING AND TECHNOLOGY

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www.avanthienggcollege.ac.in, mail: principal@avanthienggcollege.ac.in

Academic Regulations (R24) for M.Tech (Regular) Degree Course

(Applicable for the students of M.Tech from the Academic Year 2024-2025 onwards)

1. ELIGIBILITY FOR ADMISSIONS

Admission to the above program shall be made subject to eligibility, qualification and specialization as prescribed by the Institute from time to time.

Admissions shall be made on the basis of merit/rank obtained by the candidates at the qualifying Entrance Test conducted by the Institute or on the basis of any other order of merit as approved by the Institute, subject to reservations as laid down by the Govt. from time to time.

2. AWARD OF M. Tech DEGREE

a) A student shall be declared eligible for the award of the M.Tech Degree, if he pursues a course of study in not less than two and not more than four academic years.

b) The student shall register for all 68 credits and secure all the 68 credits.

c) The minimum instruction days in each semester are 90.

3. PROGRAMME OF STUDY

The following specializations are offered at present for the M.Tech Programme of study.

M.Tech

1. M.Tech- Computer Science & Engineering
2. M.Tech- Power Systems
3. M.Tech- Power Electronics
4. M.Tech- Digital Electronics and Communication Systems
5. M.Tech- VLSI Design

And any other course as approved by AICTE/University from time to time.

4. Departments offering M. Tech Programmes with specializations are noted below:

Department	Programme Code	Title
EEE	56	M.Tech- Power Systems

EEE	43	M.Tech- Power Electronics
ECE	38	M.Tech- Digital Electronics and Communication Systems
ECE	72	M.Tech - VLSI Design
CSE	58	M.Tech - Computer Science & Engineering

5. ATTENDANCE

a) A student shall be eligible to write the examinations of the institute if he acquires a minimum of 75% of attendance in aggregate of all the subjects / courses, and with minimum 50% in each and every course including practicals.

b) Condonation of shortage of attendance in aggregate up to 10% (65% and above and below 75%) in each semester shall be granted by the College Academic Committee.

c) Shortage of Attendance **below** 65% in aggregate shall not be condoned and not eligible to write their end semester examination of that class.

d) Students whose shortage of attendance is not condoned in any semester are not eligibleto write their end semester examination of that class.

e) A prescribed fee shall be payable towards condonation of shortage of attendance.

f) A student shall not be promoted to the next semester unless he satisfies the attendance requirement of the present semester, as applicable. They may seek re-admission into that semester when offered next. If any candidate fulfills the attendance requirement in the present semester, he shall not be eligible for re-admission into the same class.

6. EVALUATION

The performance of the candidate in each semester shall be evaluated subject-wise, with a maximum of 100 marks for theory and 100 marks for practical, on the basis of InternalEvaluation and End Semester Examination.

a) For the theory subjects 75 marks shall be awarded based on the performance in the End Semester Examination and 25 marks shall be awarded based on the Internal Evaluation. The internal evaluation shall be made based on the **average** of the marks secured in the two Mid Term-Examinations conducted-one in the middle of the Semester and the other immediately after the completion of instruction. Each midterm examination shall be conducted for a total duration of 120 minutes with 4 questions (without choice) each question for 10 marks, and it will be reduced to 25 marks. End semester examination is conducted for 75 marks for all FIVE (5) questions (one question from one unit) to be answered (either or).

b) For practical subjects, 75 marks shall be awarded based on the performance in the End Semester Examinations and 25 marks shall be awarded based on the day-to-day performance as Internal Marks. The internal evaluation based on the day to day work-5 marks, record- 5 marks and the remaining 15 marks to be awarded by conducting an internal laboratory test. The end examination shall be conducted by the examiners, with a breakup mark of Procedure-20, Experimentation-30, Results-10, and Viva-voce-15.

c) For Mini Project with Seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, supervisor / mentor and two other senior faculty members of the department. For Mini Project with Seminar, there will be only internal evaluation of 100 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

d) A candidate shall be deemed to have secured the minimum academic requirement in a subject if he secures a minimum of 40% of marks in the End semester Examination and a minimum aggregate of 50% of the total marks in the End Semester Examination and Internal Evaluation taken together.

e) In case the candidate does not secure the minimum academic requirement in any subject (as specified in 5.4) he has to re-appear for the End semester Examination in that subject. A candidate shall be given one chance to re-register for each subject provided, the internal marks secured by a candidate are less than 50% and has failed in the end examination. In such a case, the candidate must re-register for the subject(s) and secure the required minimum attendance. The candidate's attendance in the re-registered subject(s) shall be calculated separately to decide upon his eligibility for writing the end examination in those subject(s). In the event of the student taking another chance, his internal marks and end examination marks obtained in the previous attempt shall stand cancelled. For re-registration, the candidates have to apply to the college by paying the requisite fees and get approval from the institute before the start of the semester in which re-registration is required.

f) In case the candidate secures less than the required attendance in any re-registered subject(s), he shall not be permitted to write the End Examination in that subject. He shall again re-register the subject when next offered.

g) Laboratory examination for M. Tech. courses must be conducted with two Examiners, one of them being the Laboratory Class Teacher or teacher of the respective college and the

second examiner shall be appointed by the institute from the panel of examiners submitted by the respective departments.

7. EVALUATION OF PROJECT/DISSERTATION WORK

Every candidate shall be required to submit a thesis or dissertation on a topic approved by the Project Review Committee.

a) A Project Review Committee (PRC) shall be constituted with Head of the Department and two other senior faculty members in the department.

b) Registration of Dissertation/ Project Work: A candidate is permitted to register for the project work after satisfying the attendance requirement of all the subjects, both theory and practical.

c) After satisfying 6.2, a candidate has to submit, in consultation with his project supervisor, the title, objective and plan of action of his project work for approval. The student can initiate the Project work, only after obtaining the approval from the Project Review Committee (PRC).

d) If a candidate wishes to change his supervisor or topic of the project, he can do so with the approval of the Project Review Committee (PRC). However, the PRC shall examine whether or not to change the topic/supervisor leads to a major change in initial plans of project proposal. If yes, his date of registration for the project work starts from the date of change of Supervisor or topic as the case may be.

e) Continuous assessment of Dissertation-I and Dissertation-II during the Semester(s) will be monitored by the PRC.

f) A candidate shall submit his status report in two stages to the PRC, at least with a gap of 3 months between them.

g) The work on the project shall be initiated at the beginning of the II year and the duration of the project is two semesters. A candidate is permitted to submit Project Thesis only after successful completion of theory and practical course with the approval of PRC not earlier than 40 weeks from the date of registration of the project work. The candidate has to pass all the theory and practical subjects before submission of the Thesis.

h) Three copies of the Project Thesis certified by the supervisor shall be submitted to the College/School/Institute.

i) The thesis shall be adjudicated by one examiner selected by the institute. For this, the Principal of the College shall submit a panel of 5 examiners, eminent in that field, with the help of the guide concerned and head of the department.

j) If the report of the examiner is not favorable, the candidate shall revise and resubmit the Thesis, in the time frame as decided by the PRC. If the report of the examiner is

unfavorable again, the thesis shall be summarily rejected. The candidates have to re-registered for the project and complete the project within the stipulated time after taking the approval from the Institute.

k) The Head of the Department shall coordinate and make arrangements for the conduct of Viva-Voce examination.

l) If the report of the examiner is favorable, Viva-Voce examination shall be conducted by a board consisting of the Supervisor, Head of the Department and the examiner who adjudicated the Thesis. The Board shall jointly report the candidate's work for a maximum of 100 marks as one of the following:

I. Excellent
II. Good
III. Satisfactory
IV. Unsatisfactory

m) If the report of the Viva-Voce is unsatisfactory (ie, < 50 marks), the candidate shall retake the Viva- Voce examination only after three months. If he fails to get a satisfactory report at the second Viva-Voce examination, the candidate has to re-register for the project and complete the project within the stipulated time after taking the approval from the college.

8. Cumulative Grade Point Average (CGPA)

As measure of the student's performance, a 10-point Absolute Grading System using the following Letter Grades and corresponding percentage of marks shall be followed: **A**fter each course is evaluated for 100 marks, the marks obtained in each course will be converted to a corresponding letter grade as given below, depending on the range in which the marks obtained by the student fall.

Structure of Grading of Academic Performance

Marks Range Theory/ Laboratory (Max – 100)	Marks Range Mini Project/ Project Work or Dissertation (Max – 100)	Letter Grade	Level	Grade Point
≥ 90	≥ 90	S	Superior	10
≥80 to <90	≥80 to <90	A	Excellent	9
≥70 to <80	≥70 to <80	B	Very Good	8
≥60 to <70	≥60 to <70	C	Good	7
≥50 to <60	≥50 to <60	D	Average	6
<50	<50	F	Fail	0
		AB	Absent	0

i) A student obtaining Grade "F" or Grade "Ab" in a subject shall be considered failed and will be required to reappear for that subject when it is offered the next supplementary examination.

ii) For non-credit audit courses, "Satisfactory" or "Unsatisfactory" shall be indicated instead of the letter grade and this will not be counted for the computation of SGPA/ CGPA / Percentage.

Computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

SGPA: The Semester Grade Point Average (SGPA) is the ratio of sum of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses under gone by a student, i.e.,

$$\mathbf{SGPA=\Sigma\ (C_i \times G_i)\ /\ \Sigma\ C_i}$$

Where, C_i is the number of credits of the i^{th} subject and G_i is the grade point scored by the student in the i^{th} course.

CGPA: The Cumulative Grade Point Average (CGPA) will be computed in the same manner considering all the courses under gone by a student over all the semesters of a program, i.e.

$$\mathbf{CGPA=\Sigma\ (C_i \times S_i)\ /\ \Sigma C_i}$$

Where "S_i" is the SGPA of the i^{th} semester and C_i is the total number of credits up to that semester.

Both SGPA and CGPA shall be rounded off to 2 decimal points and reported in the transcripts. While computing the SGPA the subjects in whom the student is awarded Zero grade points will also be included.

Equivalent Percentage = (CGPA-0.75)*10

Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by the letters S, A, B, C, D and F.

9. AWARD OF DEGREE AND CLASS

After a student has satisfied the requirements prescribed for the completion of the program and is eligible for the award of M. Tech. Degree he shall be placed in one of the following four classes:

Class Awarded	CGPA to be secured	
First Class with Distinction	**≥ 7.75 (Without any supplementary appearance)**	**From the CGPA secured from 68 Credits.**
First Class	**≥ 7.75 (With any supplementary appearance)** **≥ 6.75 and < 7.75 (Without any**	

	supplementary appearance)	
Second Class	**≥ 6.75 and < 7.75 (With any supplementary appearance)** **≥ 6.0 to < 6.75 (Without any supplementary appearance)**	
Pass Class	**≥ 6.0 to < 6.75 (With any supplementary appearance)**	

The Grades secured, Grade points and Credits obtained will be shown separately in the memorandum of marks.

10. WITH HOLDING OF RESULTS

If the student is involved in indiscipline/malpractices/court cases, the result of the student will be withheld.

11. TRANSITORY REGULATIONS (For R24)

a) Discontinued or detained candidates are eligible for re-admission into same or equivalent subjects at a time as and when offered.

b) The candidate who fails in any subject will be given two chances to pass the same subject; otherwise, he has to identify an equivalent subject as per R19 (JNTUK) academic regulations.

12. GENERAL

a) Wherever the words “he”, “him”, “his”, occur in the regulations, they include “she”, “her”, “hers”.

b) The academic regulation should be read as a whole for the purpose of any interpretation.

c) In the case of any doubt or ambiguity in the interpretation of the above rules, the decision of the Principal / Dean-Academics of the institution is final.

d) The Institute may change or amend the academic regulations or syllabi at any time and the changes or amendments made shall be applicable to all the students with effect from the dates notified by the Institute.

MALPRACTICES RULES

DISCIPLINARY ACTION FOR / IMPROPER CONDUCT IN EXAMINATIONS

S.No	Nature of Malpractices / Improper conduct	Punishment
	If the candidate:	
1	(a) Possesses or keeps accessible in examination hall, any paper, note book, programmable calculators, Cell phones, pager, palm computers or any other form	Expulsion from the examination hall and cancellation of the performance in that subject only of all the candidates involved. In case of anoutsider, he will be handed over

	of material concerned with or related to the subject of the examination (theory or practical) in which he is appearing but has not made use of (material shall include any marks on the body of the candidate which can be used as an aid in the subject of the examination) (b) Gives assistance or guidance or receivesit from any other candidate orally or by any other body language methods or communicates through cell phones with any candidate or persons in or outside the exam hall in respect of any matter.	to the police anda case is registered against him.
2	Has copied in the examination hall from any paper, book, programmable calculators, palm computers or any other form of material relevant to the subject of the examination (theory or practical) in which the candidate is appearing.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted to appear for the remaining examinations of the subjects of that Semester/year. The Hall Ticket of the candidate is to be cancelled and sent to the University.
3	Impersonates any other candidate in connection with the examination.	The candidate who has impersonated shall be expelled from examination hall. The candidate is also debarred and forfeits the seat. The performance of the original candidate, who has been impersonated, shall be cancelled in all the subjects of the examination (including practical's and project work) already appeared and shall not be allowed to appear for examinations of the remaining subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat. If the imposter is an outsider, he will be handed over to the police and a case is registered against him.
4	Smuggles in the Answer book or additional	Expulsion from the examination hall and

	sheet or takes out or arranges to send out the question paper during the examination or answer book or additional sheet, during or after the examination.	cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External examinations. The continuation of the course by the candidate is subject to the academic regulations in connection with forfeiture of seat.
5	Uses objectionable, abusive or offensive language in the answer paper or in lettersto the examiners or writes to the examiner requesting him to award pass marks.	Cancellation of the performance in that subject.
6	Refuses to obey the orders of the Chief Superintendent/Assistant–Superintendent/ any officer on duty or misbehaves or creates disturbance of any kind in and around the examination hall or organizes a walk out or instigates others to walk out, or threatens the officer-in charge or any person on duty in or outside the examination hall of any injury to his person or to any of his relations whether by words, either spoken or written or by signs or by visible representation, assaults the officer-in-charge, or any person on duty in or outside the examination hall or any of his relations, or indulges in any other act of misconduct or mischief which result in damage to or destruction of property in the examination hall or any part of the College campus or engages in any other act which in the opinion of the officer on duty amounts to use of unfair means or misconduct or has the tendency to disrupt the orderly conduct of the examination.	In case of students of the college, they shall be expelled from examination halls and cancellation of their performance in that subject and all other subjects the candidate(s) has (have) already appeared and shall not be permitted to appear for the remaining examinations of the subjects of that semester/year. The candidates also are debarred and forfeit their seats. In case of outsiders, they will be handed over to the police and a police case is registered against them.
7	Leaves the exam hall taking away answer script or intentionally tears of the script or any part thereof inside or outside the examination hall.	Expulsion from the examination hall and cancellation of performance in that subject and all the other subjects the candidate has already appeared including practical examinations and project work

		and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred for two consecutive semesters from class work and all External examinations. The continuation of the course by the candidate is subject to the Academic regulations in connection with forfeiture of seat.
8	Possess any lethal weapon or firearm in the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat.
9	If student of the college, who is not a candidate for the particular examination or any person not connected with the college indulges in any malpractice or improper conduct mentioned in clause 6 to 8.	Student of the colleges expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester/year. The candidate is also debarred and forfeits the seat. Person(s) who do not belong to the College will be handed over to police and, a police case will be registered against them.
10	Comes in a drunken condition to the examination hall.	Expulsion from the examination hall and cancellation of the performance in that subject and all other subjects the candidate has already appeared including practical examinations and project work and shall not be permitted for the remaining examinations of the subjects of that semester / year.
11	Copying detected on the basis of internal evidence, such as, during valuation or during special scrutiny.	Cancellation of the performance in that subject and all other subjects the candidate has appeared including practical examinations and project work of that semester/year examinations.

12	If any malpractice is detected which is not covered in the above clauses 1 to 11 shall be reported to the Institute for further action to award suitable punishment	

Malpractices identified by squad or special invigilators

1. Punishments to the candidates as per the above guidelines.
2. Punishment for institutions : (if the squad reports that the college is also involved in encouraging malpractices)
   - (i) A show cause notice shall be issued to the college.
   - (ii) Impose a suitable fine on the college.
   - (iii) Shifting the examination centre from the college to another college for a specific period of not less than one year.

Seminar/ comprehensive vivo evaluation

There shall be two seminar presentations during III semester and IV semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

(a) For Ist & IInd semesters Seminar 100 marks are allotted for each, which shall be awarded based on the performance of the student on the selected advanced topic which is subdivided as follows.

Marks for assignment	-	20
Marks for Power Point Presentation	-	60
Marks for viva voce (Orals)	-	20
Total marks	-	100

(b) There shall be two seminar presentations during III semester and IV semester. For seminar, a student under the supervision of a faculty member, shall collect the literature on a topic and critically review the literature and submit it to the department in a report form and shall make an oral presentation before the Project Review Committee (PRC) consisting of Head of the Department, Supervisor and two other senior faculty members of the department. For each Seminar there will be only internal evaluation of 50 marks. A candidate has to secure a minimum of 50% of marks to be declared successful.

(Dr. R Prasad Rao)
Dean(Academics) &
Member Secretary (AC)

(Dr.C P V N J Mohan Rao)
Chairman
Academic Council

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Department of ELECTRONICS AND COMMUNICATION ENGINEERING

Program: M.Tech- DECS **Regulation: R24**

I Year I Semester- Course Structure

S.No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	PC	2438PC01	Digital System Design	3	0	0	3
2	PC	2438PC02	Digital Data Communications	3	0	0	3
3	PE	**Professional Elective I**		3	0	0	3
		2438PE01.1	1. Transform Techniques				
		2438PE01.2	2. VLSI Technology and Design				
		2438PE01.3	3. Radar Signal Processing				
4	PE	**Professional Elective II**		3	0	0	3
		2438PE02.1	1. Statistical Signal Processing				
		2438PE02.2	2. Optical Communication Technology				
		2438PE02.3	3. Network Security & Cryptography				
5	PC	2438PC03	System Design Using Verilog HDL Laboratory	0	0	4	2
6	PC	2438PC04	Data Communications Laboratory	0	0	4	2
7	MC	2438MTMC01	Research Methodology and IPR	2	0	0	2
8	AC	**Audit Course 1**		2	0	0	0
		2438AC01.1	1. English for Research paper writing				
		2438AC01.2	2. Disaster Management				
Total				16	0	8	18

Category	Courses	Credits
PC- Professional Core Course	4	10
PE- Professional Elective	2	6
MC-Mandatory Course	1	2
AC- Audit Course	1	0
Total	**8**	**18**

Department of ELECTRONICS AND COMMUNICATION ENGINEERING

Program: M.Tech-DECS **Regulation: R24**

I Year II Semester- Course Structure

S.No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	**PC**	**2438PC05**	Image and Video Processing	3	0	0	3
2	**PC**	**2438PC06**	Wireless Communications and Networks	3	0	0	3
3	**PE**	**Professional Elective III**		3	0	0	3
		2438PE03.1	**1.** CMOS Analog & Digital IC Design				
		2438PE03.2	**2.** Advanced Computer Architecture				
		2438PE03.3	3. Soft Computing Techniques				
4	**PE**	**Professional Elective IV**		3	0	0	3
		2438PE04.1	**1.** DSP Processors and Architectures				
		2438PE04.2	2. EMI/ EMC				
		2438PE04.3	3. Object Oriented Programming				
5	**PC**	**2438PC07**	Advanced Communications Laboratory	0	0	4	2
6	**PC**	**2438PC08**	Advanced digital Image processing Laboratory	0	0	4	2
7	**PR**	**2438PR01**	Mini Project (Seminar)	0	0	4	2
8	**AC**	**Audit Course 2**		2	0	0	0
		2438AC02.1	1. Constitution of India				
		2438AC02.2	2. Value Education				
Total				14	0	12	18

*Students be encouraged to go to Industrial Training/Internship for at least 2-3 weeks during semester break.

Category	Courses	Credits
PC- Professional Core Course	4	10
PE- Professional Elective	2	6
PR-Mini Project	1	2
AC- Audit Course	1	0
Total	**8**	**18**

DIGITAL SYSTEM DESIGN

Course Title: DIGITAL SYSTEM DESIGN	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PC01
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Fundamentals of Electronics, Linear Circuit Analysis, Digital Logic Design, Semiconductor Physics, Signal Processing Fundamentals.	

COURSE OBJECTIVES

The main objectives of this course are given below:

1. The basic concepts of K-map, tabular method, QM method are revised and higher order minimization techniques like CAMP algorithm and Cubical operations are explained.
2. PLA folding using COMPACT algorithms studied for various cases.
3. ASM charts are revised and design techniques of digital circuit realization are explained.
4. Digital system design is approached using CPLD, FPGA and ASIC.
5. Fault Diagnosis in Combinational Circuits are performed using various techniques like fault detection test, path sensitization method and Boolean difference method, Kohavi algorithm.
6. Fault Diagnosis in sequential circuits is performed using Circuit test approach, Hamming
7. Experiments, synchronizing experiments, distinguishing and adaptive distinguishing experiments on different cases.

COURSE OUTCOMES:

At the end of this course the student can able to:

CO1	Understand the basic concepts of a Karnaugh Map (“K-map”) for a 2-, 3-, 4-, or 5-variable logic function and to identify the prime implicates, essential prime implicates, and nonessential prime implicates of a function depicted on a K-map.
CO2	Perform the minimization of a Boolean function using tabular method, QM algorithm and CAMP algorithm and determine the Adjacencies, DA, CSC, SSMs, EPCs and SPCs.
CO3	Perform the minimization of PLA using IISc algorithm and folding using COMPACT algorithm.
CO4	Can design a digital circuit by steps involving ASM chart.
CO5	Understand the digital system design approaches using CPLDs, FPGAs and ASICs.
CO6	Rectify a single fault and multiple faults in combinational circuits using Path sensitization method, Boolean difference method and Kohavi algorithm.
CO7	Perform fault diagnosis in sequential circuits.

UNIT-I: Minimization Procedures and CAMP Algorithm:

Review on minimization of switching functions using tabular methods, k-map, QM algorithm, CAMP-I algorithm,

Phase-I: Determination of Adjacencies, DA, CSC, SSMs and EPCs, CAMP-I algorithm,

Phase-II: Passport checking,Determination of SPC,

CAMP-II algorithm: Determination of solution cube, Cube based operations, determination of selected cubes are wholly within the given switching function or not, Introduction to cube based algorithms.

UNIT-II:PLA Design, Minimization and Folding Algorithms:
Introduction to PLDs, basic configurations and advantages of PLDs, PLA-Introduction, Block diagram of PLA, size of PLA, PLA design aspects, PLA minimization algorithm(IISc algorithm), PLA folding algorithm(COMPACT algorithm)-Illustration of algorithms with suitable examples.

UNIT -III: Design of Large Scale Digital Systems:
Algorithmic state machine charts-Introduction, Derivation of SM Charts, Realization of SM Chart, control implementation, control unit design, data processor design, ROM design, PAL design aspects, digital system design approaches using CPLDs, FPGAs and ASICs.

UNIT-IV: Fault Diagnosis in Combinational Circuits:
Faults classes and models, fault diagnosis and testing, fault detection test, test generation, testing process, obtaining a minimal complete test set, circuit under test methods- Path sensitization method, Boolean difference method, properties of Boolean differences, Kohavi algorithm, faults in PLAs, DFT schemes, built in self-test.

UNIT-V: Fault Diagnosis in Sequential Circuits:
Fault detection and location in sequential circuits, circuit test approach, initial state identification, Haming experiments, synchronizing experiments, machine identification, distinguishing experiment, adaptive distinguishing experiments.

Text Books:

1. Logic Design Theory-N. N. Biswas, PHI
2. Switching and Finite Automata Theory-Z. Kohavi , 2nd Edition, 2001, TMH
3. Digital system Design using PLDd-Lala

Reference Books:

1. Fundamentals of Logic Design – Charles H. Roth, 5th Ed., Cengage Learning.
2. Digital Systems Testing and Testable Design – MironAbramovici, Melvin A. Breuer and Arthur D. Friedman- John Wiley & Sons Inc.

Web References:

1. https://www.geeksforgeeks.org/principles-in-digital-system-design/
2. https://onlinecourses.nptel.ac.in/noc21_ee39/preview
3. https://digitalsystemdesign.in/?srsltid=AfmBOor3qLbyJAL2zRVmXPXEgd3YK8wI1mJ5wCzeJ8hpQUzfunx_Tclz

DIGITAL DATA COMMUNICATIONS

Course Title: DIGITAL DATA COMMUNICATIONS	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PC02
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Digital Signal Processing, Communication Systems, Basic Electronics, Probability and Statistics, Network Theory	

Course objectives

The main objectives of this subject are:

1. Different modulation techniques to improve the bandwidth and their properties.
2. Networking and different protocol systems.
3. Error estimation and correction, asynchronous and synchronous protocols.
4. Multiplexing techniques, different networking connections and interfacing devices.
5. Multiple access techniques and analysis.

Course outcomes:

At the end of this course the student can able to:

CO1	Model digital communication system using appropriate mathematical techniques (error probability, constellation diagrams, pharos diagrams).
CO2	Understanding the basic concepts of how digital data is transferred across computer networks.
CO3	Independently understand basic computer network technology.
CO4	Understand and explain Data Communications System and its components.
CO5	Identify the different types of network topologies and protocols.
CO6	Enumerate the layers of the OSI model and TCP/IP. Explain the function(s) of each layer.
CO7	Identify the different types of network devices and their functions within a network
CO8	Understand and building the skills of sub netting and routing mechanisms.
CO9	Familiarity with the basic protocols of computer networks, and how they can be used
CO10	To assist in network design and implementation.

UNIT -I:

Digital Modulation Schemes:

BPSK, QPSK, 8PSK, 16PSK, 8QAM, 16QAM, DPSK – Methods, Band Width Efficiency, Carrier Recovery, Clock Recovery.

UNIT -II:

Basic Concepts of Data Communications, Interfaces and Modems:

Data Communication Networks, Protocols and Standards, UART, USB, Line Configuration, Topology, Transmission Modes, Digital Data Transmission, DTE-DCE interface, Categories of Networks – TCP/IP Protocol suite and Comparison with OSI model.

UNIT -III:

Error Correction: Types of Errors, Vertical Redundancy Check (VRC), LRC, CRC, Checksum, Error Correction using Hamming code

Data Link Control: Line Discipline, Flow Control, Error Control

Data Link Protocols: Asynchronous Protocols, Synchronous Protocols, Character Oriented Protocols, Bit-Oriented Protocol, Link Access Procedures.

UNIT -IV:

Multiplexing: Frequency Division Multiplexing (FDM), Time Division Multiplexing (TDM), Multiplexing Application, DSL.

Local Area Networks: Ethernet, Other Ether Networks, Token Bus, Token Ring, FDDI.

Metropolitan Area Networks: IEEE 802.6, SMDS

Switching: Circuit Switching, Packet Switching, Message Switching.

Networking and Interfacing Devices: Repeaters, Bridges, Routers, Gateway, Other Devices.

UNIT -V:

Multiple Access Techniques: Frequency- Division Multiple Access (FDMA), Time - Division Multiple Access (TDMA), Code - Division Multiple Access (CDMA), OFDM and OFDMA. Random Access, Aloha- Carrier Sense Multiple Access (CSMA)- Carrier Sense Multiple Access with Collision Avoidance (CSMA/CA), Controlled Access- Reservation- Polling- Token Passing, Channelization.

TEXT BOOKS:

1. Data Communication and Computer Networking - B. A. Forouzan, 2nd Ed., 2003, TMH.
2. Advanced Electronic Communication Systems - W. Tomasi, 5th Ed., 2008, PEI.

REFERENCE BOOKS:

1. Data Communications and Computer Networks - Prakash C. Gupta, 2006, PHI.
2. Data and Computer Communications - William Stallings, 8th Ed., 2007, PHI.
3. Data Communication and Tele Processing Systems -T. Housely, 2nd Ed, 2008, BSP.
4. Data Communications and Computer Networks- Brijendra Singh, 2ndEd., 2005, PHI.

Web References:

1. https://control.com/textbook/digital-data-acquisition-and-networks/digital-data-communication-theory/
2. https://archive.nptel.ac.in/courses/106/105/106105082/

TRANSFORM TECHNIQUES (ELECTIVE – I)

Course Title: **Transform Techniques**	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PE01.1
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Linear Algebra, Calculus, Probability and Statistics, Complex Analysis, Differential Equations	

Course Objectives:

The main objectives of this subject are:

1. Understand the fundamental principles and applications of various transform techniques.
2. Develop proficiency in applying Fourier and Laplace transforms to solve differential equations.
3. Explore the use of Z-transforms in discrete-time signal analysis and system modeling.
4. Analyze functions and signals in different domains to facilitate problem-solving in engineering and science.
5. Gain skills in using transforms for data processing, control systems, and image processing applications.

Course Outcomes:

On completion of this course student will be able to:

CO1	The student will learn basics of two-dimensional transforms.
CO2	Understand the definition, properties and applications of various two-dimensional transform.
CO3	Understand the basic concepts of wavelet transform.
CO4	Understand the special topics such as wavelet packets, Bi-orthogonal wavelets e.t.c.

UNIT -I:

Fourier Analysis:

Fourier series, Examples, Fourier Transform, Properties of Fourier Transform, Examples of Fourier transform, sampling theorem, Partial sum and Gibbs phenomenon, Fourier analysis of Discrete time Signals, Discrete Fourier Transform.

Time – Frequency Analysis: Window function, Short Time Fourier Transform, Discrete Short Time Fourier Transform, Continuous wavelet transform, Discrete wavelet transform, wavelet series, Interpretations of the Time-Frequency plot.

UNIT -II:

Transforms:

Walsh, Hadamard, Haar and Slant Transforms, DCT, DST, KLT, Singular value Decomposition – definition, properties and applications

UNIT -III:

Continuous Wavelet Transform (CWT):

Short comings of STFT, Need for wavelets, Wavelet Basis- Concept of Scale and its relation with

frequency, Continuous time wavelet Transform Equation- Series Expansion using Wavelets- CWT- Tiling of time scale plane for CWT. Important Wavelets: Haar, Mexican Hat, Meyer, Shannon, Daubechies.

UNIT -IV:

Multi Rate Analysis and DWT:

Need for Scaling function – Multi Resolution Analysis, Two-Channel Filter Banks, Perfect Reconstruction Condition, Relationship between Filter Banks and Wavelet Basis, DWT, Structure of DWT Filter Banks, Daubechies Wavelet Function, Applications of DWT.

UNIT -V:

Wavelet Packets and Lifting: Wavelet Packet Transform, Wavelet packet algorithms, Thresholding- Hard thresholding, soft thresholding, Multidimensional Wavelets, Bi-orthogonal basis- B-Splines, Lifting Scheme of Wavelet Generation, Multi Wavelets

Text Books:

1. A Wavelet Tour of Signal Processing theory and applications -RaghuveerM.Rao and Ajit S. Bopardikar, Pearson Edu, Asia, New Delhi, 2003.
2. K.P.Soman and K.I Ramachandran, " Insight into Wavelets – from theory to practice" PHI, Second edition,2008.

Reference Books:

1. Fundamentals of Wavelets- Theory, Algorithms and Applications -Jaideva C Goswami, Andrew K Chan, John Wiley & Sons, Inc, Singapore, 1999.
2. Jaideva C. Goswami and Andrew K. Chan, " Fundamentals of Wavelets" Wiley publishers, 2006
3. A Wavelet Tour of Signal Processing-Stephen G. Mallat, Academic Press, 2 Ed
4. Digital Image Processing – S. Jayaraman, S. Esakkirajan, T. Veera Kumar – TMH,2009

Web References:

1. https://archive.nptel.ac.in/courses/111/106/111106111/
2. https://onlinecourses.nptel.ac.in/noc23_ma43/preview

VLSI TECHNOLOGY AND DESIGN (ELECTIVE – I)

Course Title: **VLSI TECHNOLOGY AND DESIGN**	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PE01.2
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Digital Logic Design, Semiconductor Physics, Analog Circuits, Microelectronics, Circuit Analysis	

Course Objectives:

The main objectives of this subject are:

1. Understand the fundamentals of VLSI technology and the design process for integrated circuits.
2. Learn the principles and techniques for designing digital and analog circuits on silicon chips.
3. Develop proficiency in using CAD tools for VLSI design, simulation, and verification.
4. Explore fabrication methods and physical layout techniques for optimized chip performance.
5. Gain insights into low-power design, testing, and reliability in VLSI systems.

Course Outcomes:

On completion of this course student will be able to:

CO1	Review of FET fundamentals for VLSI design.
CO2	To acquires knowledge about stick diagrams and layouts.
CO3	Enable to design the subsystems based on VLSI concepts.

UNIT-I:

VLSI Technology: Fundamentals and applications, IC production process, semiconductor processes, design rules and process parameters, layout techniques and process parameters.

VLSI Design: Electronic design automation concept, ASIC and FPGA design flows, SOC designs, design technologies: combinational design techniques, sequential design techniques, state machine logic design techniques and design issues.

UNIT-II:

CMOS VLSI Design: MOS Technology and fabrication process of P-MOS , N-MOS , CMOS and Bi-CMOS technologies, comparison of different processes.

Building Blocks of a VLSI circuit: Computer architecture, memory architectures, communication interfaces, mixed signal interfaces.

VLSI Design Issues: Design process, design for testability, technology options, power calculations, package selection, clock mechanisms, mixed signal design.

UNIT-III:

Basic electrical properties of MOS and Bi-CMOS circuits, MOS and Bi-CMOS circuit design processes, Basic circuit concepts, scaling of MOS circuits-qualitative and quantitative analysis with proper illustrations and necessary derivations of expressions.

UNIT-IV:

Subsystem Design and Layout: Some architectural issues, switch logic, gate logic, examples of structured design (combinational logic), some clocked sequential circuits, other system

considerations.
Subsystem Design Processes: Some general considerations and an illustration of design processes, design of an ALU subsystem.

UNIT-V:
Floor Planning: Introduction, Floor planning methods, off-chip connections.
Architecture Design: Introduction, Register-Transfer design, high-level synthesis, architectures for low power, architecture testing.
Chip Design: Introduction and design methodologies.

Text Books:

1. Essentials of VLSI Circuits and Systems, K. Eshraghian, Douglas A. Pucknell, Sholeh Eshraghian, 2005, PHI Publications.
2. Modern VLSI Design-Wayne Wolf, 3rd Ed., 1997, Pearson Education.
3. VLSI Design-Dr. K. V. K. K. Prasad, Kattula Shyamala, Kogent Learning Solutions Inc., 2012.

Reference Books:

1. VLSI Design Technologies for Analog and Digital Circuits, Randall L.Geiger, Phillip E.Allen, Noel R.Strader, TMH Publications, 2010.
2. Introduction to VLSI Systems: A Logic, Circuit and System Perspective- Ming-BO Lin, CRC Press, 2011.
3. Principals of CMOS VLSI Design-N.H.E Weste, K. Eshraghian, 2nd Edition, Addison Wesley.

Web References:

1. https://www.tutorialspoint.com/vlsi_design/vlsi_design_digital_system.htm
2. https://nptel.ac.in/courses/117106092

RADAR SIGNAL PROCESSING (ELECTIVE -I)

Course Title: **RADAR SIGNAL PROCESSING**	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PE01.3
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Mathematics for Signals and Systems, Probability and Statistics, Fourier Analysis, Digital Signal Processing, Linear Algebra	

Core Objectives:

The main objectives of this subject are:

1. Derivation of Radar range and Design of matched filter for different noises.
2. Signal detection techniques at receiver.
3. Optimum Radar Waveforms for Detection of signals in Clutter and various Families.
4. The characteristics of a Linear pulse and digital compression to Radar signals.
5. The principles of different phase coding techniques and analysis.

Course Outcomes:

At the end of this course the student can able to:

CO1	Understand the operation of Radar and characteristics of Matched filter for non-white noise.
CO2	Understand the various detection criterion and types of detectors that can be used to detect the Radar signals in noise.
CO3	Understand the waveform design requirements and optimum waveforms for the detection of signals in clutter.
CO4	Know the significance and types of pulse compression techniques for analog and digital signals.
CO5	Understand the requirements of phase coding in Radar and various poly phase codes used for phase coding.

UNIT -I:

Introduction:

Radar Block Diagram, Bistatic Radar, Monostatic Radar, Radar Equation, Information Available from Radar Echo. Review of Radar Range Performance– General Radar Range Equation, Radar Detection with Noise Jamming, Beacon and Repeater Equations, MTI and Pulse Doppler Radar.

Matched Filter Receiver – Impulse Response, Frequency Response Characteristic and its Derivation, Matched Filter and Correlation Function, Correlation Detection and Cross-Correlation Receiver, Efficiency of Non-Matched Filters, Matched Filter for Non-White Noise.

UNIT -II:

Detection of Radar Signals in Noise:

Detection Criteria – Neyman-Pearson Observer, Likelihood-Ratio Receiver, Inverse Probability Receiver, Sequential Observer, Detectors–Envelope Detector, Logarithmic Detector, I/Q Detector. Automatic Detection-CFAR Receiver, Cell Averaging CFAR Receiver, CFAR Loss, CFAR Uses in

Radar. Radar Signal Management–Schematics, Component Parts, Resources and Constraints.

UNIT -III:

Waveform Selection [3, 2]:

Radar Ambiguity Function and Ambiguity Diagram – Principles and Properties; Specific Cases – Ideal Case, Single Pulse of Sine Wave, Periodic Pulse Train, Single Linear FM Pulse, Noise Like Waveforms, Waveform Design Requirements, Optimum Waveforms for Detection in Clutter, Family of Radar Waveforms.

UNIT -IV:

Pulse Compression in Radar Signals:

Introduction, Significance, Types, Linear FM Pulse Compression – Block Diagram, Characteristics, Reduction of Time Side lobes, Stretch Techniques, Generation and Decoding of FM Waveforms – Block Schematic and Characteristics of Passive System, Digital Compression, SAW Pulse Compression.

UNIT V:

Phase Coding Techniques:

Principles, Binary Phase Coding, Barker Codes, Maximal Length Sequences (MLS/LRS/PN), Block Diagram of a Phase Coded CW Radar.

Poly Phase Codes : Frank Codes, Costas Codes, Non-Linear FM Pulse Compression, Doppler Tolerant PC Waveforms – Short Pulse, Linear Period Modulation (LPM/HFM), Sidelobe Reduction for Phase Coded PC Signals.

Text Books:

1. Radar Handbook - M.I. Skolnik, 2nd Ed., 1991, McGraw Hill.
2. Radar Design Principles : Signal Processing and The Environment - Fred E. Nathanson, 2nd Ed., 1999, PHI.
3. Introduction to Radar Systems - M.I. Skolnik, 3rd Ed., 2001, TMH.

Reference Books:

1. Radar Principles - Peyton Z. Peebles, Jr., 2004, John Wiley.
2. Radar Signal Processing and Adaptive Systems - R. Nitzberg, 1999, Artech House.

Web References:

1. https://udrc.eng.ed.ac.uk/sites/udrc.eng.ed.ac.uk/files/attachments/Introduction%20Radar%20signal%20processing.pdf
2. https://archive.nptel.ac.in/courses/108/105/108105154/

STATISTICAL SIGNAL PROCESSING (ELECTIVE - II)

Course Title: **STATISTICAL SIGNAL PROCESSING**	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PE02.1
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Probability Theory, Linear Algebra, Random Processes, Digital Signal Processing, Fourier Analysis	

Course Objectives:

The main objectives of this subject are:

- Understand signal models and characterization techniques.
- Learn spectral estimation methods for power and correlation functions.
- Review fundamentals of random processes and statistical parameter estimation.
- Explore eigen structure-based methods for frequency estimation.
- Study adaptive filtering techniques like Wiener and Kalman filtering.

Course Outcomes:

CO1	Analyze signals and develop their statistical models for efficient processing
CO2	Formulate filtering problems from real life applications and design filtering solutions to estimate a desired signal from a given mixture by minimizing a cost function
CO3	Design and analyse efficient algorithms for estimation of various parameters of signals with different constraints
CO4	Develop efficient methods for spectrum and frequency estimation suiting the requirements derived from practical problems

UNIT I

Signal models and characterization: Types and properties of statistical models for signals and how they relate to signal processing, Common second-order methods of characterizing signals including autocorrelation, partial correlation, cross-correlation, power spectral density and cross-power spectral density.

UNIT II

Spectral estimation: Nonparametric methods for estimation of power spectral density, auto-correlation, cross-correlation, transfer functions, and coherence form finite signal samples.

UNIT III

Review of signal processing: A review on random processes, A review on filtering random processes, Examples.

Statistical parameter estimation: Maximum like hood estimation, maximum a posterior estimation, Cramer-Rao bound.

UNIT IV

Eigen structure based frequency estimation: Pisarenko, MUSIC, ESPRIT their application sensor array direction finding.

Spectrum estimation: Moving average (MA), Auto Regressive (AR), Auto Regressive Moving

Average (ARMA), Various non-parametric approaches.

UNIT V

Wiener filtering: The finite impulse case, causal and non-causal infinite impulse responses cases, least mean squares adaptation, recursive least squares adaptation, Kalman filtering.

Text Books:

1. Steven M. Kay, fundamentals of statistical signal processing: estimation Theory, Pretice - Hall,1993.
2. Monsoon H. Hayes, Statistical digital signal processing and modeling, USA, Wiley,1996.

Reference Books:

1. Dimitris G. Manolakis, Vinay K. Ingle, and Stephen M. Kogon, Statistical and adaptive signal processing, Artech House, Inc,2005, ISBN 1580536107

Web References:

1. https://nptel.ac.in/courses/108103158
2. https://onlinecourses.nptel.ac.in/noc20_ee53/preview

OPTICAL COMMUNICATION TECHNOLOGY (ELECTIVE -II)

Course Title: **OPTICAL COMMUNICATION TECHNOLOGY**	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PE02.2
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Probability Theory, Linear Algebra, Random Processes, Digital Signal Processing, Fourier Analysis	

Course Objectives

The main objectives of this subject are:

1. To expose the students to the basics of signal propagation through optical fibers , fiber impairments
2. students should be familiar with commonly used components and subsystems in optical communication and network systems
3. To know the Optical Modulation and demodulation and Error Detection and Correction codes.
4. Learn about optical amplifier Transmission system model, power penalty-transmitter, power penalty-transmitter, receiver Scope – receiver optical amplifiers, crosstalk, dispersion,
5. Learn about necessity of wavelength division multiplexing (WDM), working principle and techniques of multiplexing, and Overall System Design considerations and optical networks.

Course outcomes

At the end of this course the student can able to:

CO1	Able to analyze characteristics of optical fiber and signal propagation through optical fibers
CO2	Know the commonly used components and subsystems in optical communication and network systems ,Working principle of optical communication components ,amplifiers, filters
CO3	Able to analyze Transmission system model
CO4	Understand the importance of wavelength division multiplexing (WDM) and de-multiplexing.

UNIT –I:

Signal propagation in Optical Fibers:

Geometrical Optics approach and Wave Theory approach, Loss and Bandwidth, Chromatic Dispersion, Non Linear effects- Stimulated Brillouin and Stimulated Raman Scattering, Propagation in a Non-Linear Medium, Self-Phase Modulation and Cross Phase Modulation, Four Wave Mixing, Principle of Solitons.

UNIT –II:

Fiber Optic Components for Communication & Networking:

Couplers, Isolators and Circulators, Multiplexers, Bragg Gratings, Fabry-Perot Filters, Mach Zender Interferometers, Arrayed Waveguide Grating, Tunable Filters, High Channel Count Multiplexer Architectures, Optical Amplifiers, Direct and External Modulation Transmitters, Pump Sources for

Amplifiers, Optical Switches and Wavelength Converters.

UNIT –III:

Modulation and Demodulation:

Signal formats for Modulation, Subcarrier Modulation and Multiplexing, Optical Modulations – Duobinary, Single Side Band and Multilevel Schemes, Ideal and Practical receivers for Demodulation, Bit Error Rates, Timing Recovery and Equalization, Reed-Solomon Codes for Error Detection and Correction.

UNIT -IV:

Transmission System Engineering:

System Model, Power Penalty in Transmitter and Receiver, Optical Amplifiers, Crosstalk and Reduction of Crosstalk, Cascaded Filters, Dispersion Limitations and Compensation Techniques.

UNIT –V:

Fiber Non-linearities and System Design Considerations:

Limitation in High Speed and WDM Systems due to Non-linearities in Fibers, Wavelength Stabilization against Temperature Variations, Overall System Design considerations – Fiber Dispersion, Modulation, Non-Linear Effects, Wavelengths, All Optical Networks.

Text Books:

1. Optical Networks: A Practical Perspective - Rajiv Ramaswami and Kumar N. Sivarajan, 2nd Ed., 2004, Elsevier Morgan Kaufmann Publishers (An Imprint of Elsevier).
2. Optical Fiber Communications – Gerd Keiser, 3rd Ed., 2000, McGraw Hill.

Reference Books:

1. Optical Fiber Communications: Principles and Practice – John.M.Senior, 2nd Ed., 2000, PE.
2. Fiber Optics Communication – Harold Kolimbris, 2nd Ed., 2004, PEI
3. Optical Networks: Third Generation Transport Systems – Uyless Black, 2nd Ed., 2009, PEI
4. Optical Fiber Communications – GovindAgarwal, 2nd Ed., 2004, TMH.
5. Optical Fiber Communications and Its Applications – S.C.Gupta, 2004, PHI.

Web References:

1. https://www.sciencedirect.com/topics/engineering/optical-communication-system
2. https://onlinecourses.nptel.ac.in/noc20_ee79/preview

NETWORK SECURITY AND CRYPTOGRAPHY (ELECTIVE -II)

Course Title: **NETWORK SECURITY AND CRYPTOGRAPHY**	I Year- I Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PE2.3
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Computer Networks, Operating Systems, Discrete Mathematics, Linear Algebra, Number Theory	

Course Objectives

The main objectives of this subject are:

- Understand the principles of network security and the importance of protecting information in transit and at rest.
- Learn about various cryptographic techniques and algorithms used for secure communication and data integrity.
- Explore common network security threats and vulnerabilities, and strategies to mitigate them.
- Gain practical skills in implementing security protocols and best practices for network design and management.
- Develop the ability to analyze and evaluate security policies and standards in different organizational contexts.

Course Outcomes:

At the end of the course, students will be able to:

CO1	Identify and utilize different forms of cryptography techniques.
CO2	Incorporate authentication and security in the network applications.
CO3	Distinguish among different types of threats to the system and handle the same.

UNIT -I:

Introduction:

Attacks, Services and Mechanisms, Security attacks, Security services, A Model for Internetwork security.

Classical Techniques: Conventional Encryption model, Steganography, Classical Encryption Techniques.

Modern Techniques:

Simplified DES, Block Cipher Principles, Data Encryption standard, Strength of DES, Differential and Linear Cryptanalysis, Block Cipher Design Principles and Modes of operations.

UNIT -II:

Encryption Algorithms:

Triple DES, International Data Encryption algorithm, Blowfish, RC5, CAST-128, RC2, Characteristics of Advanced Symmetric block cifers.Conventional Encryption: Placement of Encryption function, Traffic confidentiality, Key distribution, Random Number Generation.

UNIT -III:

Public Key Cryptography: Principles, RSA Algorithm, Key Management, Diffie-Hellman Key exchange, Elliptic Curve Cryptography

Number Theory: Prime and relatively prime numbers, Modular arithmetic, Fermat's and Euler's theorems, Testing for primality, Euclid's Algorithm, the Chinese remainder theorem, Discrete logarithms.

UNIT -IV:

Message Authentication and Hash Functions: Authentication requirements and functions, Message Authentication, Hash functions, Security of Hash functions and MACs.Hash and Mac Algorithms
MD File, Message digest Algorithm, Secure Hash Algorithm, RIPEMD-160, HMAC.Digital signatures and Authentication protocols: Digital signatures, Authentication Protocols, Digital signature standards.
Authentication Applications : Kerberos, X.509 directory Authentication service.Electronic Mail Security: Pretty Good Privacy, S/MIME.

UNIT –V:

IP Security:
Overview, Architecture, Authentication, Encapsulating Security Payload, Combining security Associations, Key Management. Web Security: Web Security requirements, Secure sockets layer and Transport layer security, Secure Electronic Transaction.
Intruders, Viruses and Worms
Intruders, Viruses and Related threats.
Fire Walls: Fire wall Design Principles, Trusted systems.

Text Books:

1. Cryptography and Network Security: Principles and Practice - William Stallings, Pearson Education.
2. Network Security Essentials (Applications and Standards) by William Stallings Pearson Education.

Reference Books:

1. Fundamentals of Network Security by Eric Maiwald (Dreamtech press)
2. Network Security - Private Communication in a Public World by Charlie Kaufman, Radia Perlman and Mike Speciner, Pearson/PHI.
3. Principles of Information Security, Whitman, Thomson.
4. Network Security: The complete reference, Robert Bragg, Mark Rhodes, TMH
5. Introduction to Cryptography, Buchmann, Springer.

SYSTEM DESIGN USING VERILOG HDL LABORATORY

Course Title: System Design Using Verilog HDL Laboratory	I Year- I Semester
Teaching Scheme (L:T:P): 0:0:4	Course Code: 2438PC03
Type of Course: Practicals	Credits: 2
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites:	

Course Objectives

The main objectives of this subject are:

1. To understand the fundamental concepts of digital design and simulation using Verilog HDL.
2. To develop skills in designing and implementing combinational and sequential circuits.
3. To gain hands-on experience in using simulation tools for verifying design functionality.
4. To explore synthesis techniques and their application in hardware design.
5. To foster teamwork and collaboration through group projects and design challenges.

Course Outcomes:

At the end of the laboratory work, students will be able to:

CO1	Identify, formulate, solve and implement problems in signal processing, communication systems etc using RTL design tools.
CO2	Use EDA tools like Cadence, Mentor Graphics and Xilinx.

List of Experiments:

1. Verilog implementation of 8:1 Mux/Demux, Full Adder, 8-bit Magnitude comparator, Encoder/decoder, Priority encoder, D-FF, 4-bit Shift registers (SISO, SIPO, PISO, bidirectional), 3-bit Synchronous Counters, Binary to Gray converter, Parity generator.
2. Sequence generator/detectors, Synchronous FSM – Mealy and Moore machines.
3. Vending machines - Traffic Light controller, ATM, elevator control.
4. PCI Bus & arbiter and downloading on FPGA.
5. UART/ USART implementation in Verilog.
6. Realization of single port SRAM in Verilog.
7. Verilog implementation of Arithmetic circuits like serial adder/ subtractor, parallel adder/subtractor, serial/parallel multiplier.
8. Discrete Fourier transform/Fast Fourier Transform algorithm in Verilog.

DATA COMMUNICATIONS LAB

Course Title: DATA COMMUNICATIONS LAB	I Year- I Semester
Teaching Scheme (L:T:P): 0:4:0	Course Code: 2438PC04
Type of Course: Practical	Credits: 2
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites:	

List of Experiments:

1. Study of serial interface RS – 232
2. Study of pc to pc communication using parallel port
3. To establish pc-pc communication using LAN
4. Study of LAN using star topology, bus topology and tree topology
5. Study and configure modem of a computer
6. To configure a hub/switch
7. To study the interconnections of cables for data communication
8. Study of a wireless communication system
9. Set up of time division multiplexing using fiber optics
10. Digital Fiber Optical Transmitter and Receiver

RESEARCH METHODOLOGY AND IPR

Course Title: Research Methodology and IPR	**I Year- I Semester**
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438MTMC01
Type of Course: Lecture	Credits: 2
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre requisites: Understanding of Research Design, Familiarity with Statistical Methods, Knowledge of Intellectual Property Rights, Ability to Conduct Literature Reviews, Skills in Data Collection and Analysis.	

Course Objectives:

- Understand the principles of research methodology, including research design, data collection, and analysis techniques.
- Develop skills in formulating research questions and hypotheses relevant to scientific inquiry.
- Explore the concepts of intellectual property rights (IPR) and their significance in research and innovation.
- Learn how to protect and manage intellectual property, including patents, copyrights, and trademarks.

Course Outcomes:

At the end of this course, students will be able to

CO1	Understand research problem formulation.
CO2	Analyze research related information
CO3	Follow research ethics
CO4	Understand that today's world is controlled by Computer, Information Technology, but tomorrow world will be ruled by ideas, concept, and creativity.
CO5	Understanding that when IPR would take such important place in growth of individuals & nation, it is needless to emphasis the need of information about Intellectual Property Right to be promoted among students in general & engineering in particular.
CO6	Understand that IPR protection provides an incentive to inventors for further research work and investment in R & D, which leads to creation of new and better products, and in turn brings about, economic growth and social benefits.

UNIT 1:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations

UNIT 2:

Effective literature studies approach, analysis Plagiarism , Research ethics.

UNIT 3:

Effective technical writing, how to write report, Paper Developing a Research Proposal, Format of research proposal, a presentation and assessment by a review committee.

UNIT 4:

Nature of Intellectual Property: Patents, Designs, Trademarks and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development.

International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT.

UNIT 5:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications.

UNIT 6:

New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs.

Reference Books:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students""
2. Wayne Goddard and Stuart Melville, "Research Methodology: An Introduction"
3. Ranjit Kumar, 2nd Edition , "Research Methodology: A Step by Step Guide for beginners"
4. Halbert, "Resisting Intellectual Property", Taylor & Francis Ltd ,2007.
5. Mayall , "Industrial Design", McGraw Hill, 1992.
6. Niebel , "Product Design", McGraw Hill, 1974.
7. Asimov , "Introduction to Design", Prentice Hall, 1962.
8. Robert P. Merges, Peter S. Menell, Mark A. Lemley, " Intellectual Property in New Technological Age", 2016.
9. T. Ramappa, "Intellectual Property Rights Under WTO", S. Chand, 2008

ENGLISH FOR RESEARCH PAPER WRITING

Course Title: English for Research paper writing	**I Year- I Semester**
Teaching Scheme (L:T:P): 2:0:0	Course Code: 2472AC01.1
Type of Course: Lecture	Credits: 0
Continuous Internal Evaluation: 0 Marks	Semester End Exam: 0 Marks
Pre-requisites: Understanding academic writing conventions, familiarity with research methodologies, proficiency in grammar and vocabulary, knowledge of citation styles, awareness of ethical considerations in research.	

Course objectives:

Students will be able to:

- Understand that how to improve your writing skills and level of readability Learn about what to write in each section
- Understand the skills needed when writing a Title Ensure the good quality of paper at very first-time submission

Course Outcomes:

At the end of this course, students will be able to

CO1	Demonstrate effective planning and preparation techniques for academic writing, including structuring paragraphs and sentences clearly.
CO2	Apply strategies for clarifying ideas, avoiding ambiguity, and ensuring conciseness in written communication.
CO3	Develop skills to construct well-organized sections of a paper, including abstracts, introductions, and literature reviews.
CO4	Evaluate and critique various sections of academic papers, focusing on the methods, results, and discussion.
CO5	Utilize key skills to enhance the quality of writing in academic submissions, ensuring clarity and adherence to academic standards

Unit-1

Planning and Preparation, Word Order, breaking up long sentences, Structuring Paragraphs and Sentences, Being Concise and Removing Redundancy, Avoiding Ambiguity and Vagueness

Unit-2

Clarifying Who Did What, Highlighting Your Findings, Hedging and Criticizing, Paraphrasing and Plagiarism, Sections of a Paper, Abstracts. Introduction

Unit-3

Review of the Literature, Methods, Results, Discussion,Conclusions, The Final Check.

Unit-4

key skills are needed when writing a Title, key skills are neededwhen writing an Abstract, key skills are needed when writing an Introduction, skills needed when writing a Review of the Literature.

Unit -5

skills are needed when writing the Methods, skills needed whenwriting the Results, skills are needed when writing the Discussion, skills are needed when writing the Conclusions, useful phrases, how to ensure paper is as good as it could possibly be the first- time submission

Reference Books:

1. Goldbort R (2006) Writing for Science, Yale University Press (available on Google Books)
2. Day R (2006) How to Write and Publish a Scientific Paper, Cambridge University Press
3. Highman N (1998), Handbook of Writing for the Mathematical Sciences, SIAM. Highman‟sbook .
4. Adrian Wallwork , English for Writing Research Papers, Springer NewYork

DISASTER MANAGEMENT

Course Title: Disaster Management	**I Year- I Semester**
Teaching Scheme (L:T:P): 2:0:0	Course Code: 2472AC01.2
Type of Course: Lecture	Credits: 0
Continuous Internal Evaluation: 0 Marks	Semester End Exam: 0 Marks
Pre requisites: Disaster Risk Assessment, Emergency Response Planning, Community Awareness and Education, Resource Management and Logistics, Coordination with Agencies and Stakeholders	

Course Objectives: -

Students will be able to:

- learn to demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response.
- critically evaluate disaster risk reduction and humanitarian response policy and practice from multiple perspectives.
- develop an understanding of standards of humanitarian response and practical relevance in specific types of disasters and conflict situations.
- critically understand the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly their home country or the countries they work in.

Course Outcomes: -

At the end of this course, students will be able to

CO1	Analyze and differentiate between various types of disasters, including natural and manmade, and their significance in different contexts.
CO2	Assess the economic and ecological repercussions of disasters, including the impact on human and animal life, as well as ecosystem destruction.
CO3	Identify and evaluate disaster-prone areas in India, focusing on specific hazards such as earthquakes, floods, and cyclones, and their associated risks.
CO4	Develop disaster preparedness strategies, including risk evaluation techniques and the use of remote sensing and data from various agencies for effective management.
CO5	Formulate disaster risk assessment and mitigation strategies, emphasizing community participation and emerging trends in disaster management practices.

Syllabus

Unit-1

Introduction, Disaster: Definition, Factors and Significance; Difference Between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit-2

Repercussions Of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem. Natural Disasters: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches, Man- made disaster: Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Unit-3

Disaster Prone Areas in India Study of Seismic Zones: Areas Prone to Floods and Droughts, Landslides and Avalanches; Areas Prone to Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics .

Unit-4

Disaster Preparedness and Management Preparedness: Monitoring of Phenomena Triggering a Disaster or Hazard; Evaluation of Risk: Application of Remote Sensing, Data from Meteorological and Other Agencies, Media Reports: Governmental and Community Preparedness.

Unit-5

Risk Assessment & Disaster Mitigation

Disaster Risk: Concept And Elements, Disaster Risk Reduction, Global and National Disaster Risk Situation. Techniques Of Risk Assessment, Global Co-Operation in Risk Assessment and Warning, People's Participation in Risk Assessment. Strategies for Survival. Meaning, Concept and Strategies of Disaster Mitigation, Emerging Trends in Mitigation. Structural Mitigation and Non-Structural Mitigation, Programs of Disaster Mitigation in India.

References:

1.R. Nishith, Singh AK, "Disaster Management in India: Perspectives, issues and strategies ""New Royal book Company.

2.Sahni, PardeepEt.Al. (Eds.)," Disaster Mitigation Experiences And Reflections", Prentice Hall Of India, New Delhi.

3.Goel S. L. , Disaster Administration And Management Text And Case Studies" ,Deep &Deep Publication Pvt. Ltd., New Delhi.

IMAGE AND VIDEO PROCESSING

Course Title: IMAGE AND VIDEO PROCESSING	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PC05
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Mathematics for Signal Processing, Probability and Statistics, Linear Algebra, Digital Signal Processing, Programming Skills	

Course objectives :

- The basic concepts and methods to develop foundation in digital image processing and video processing are introduced and The Importance of various image transforms, image transform properties are discussed.
- Understanding the image enhancement techniques in both spatial domain and frequency domain.
- The process of recovering image that has been degraded by noise or any other degradation phenomenon.
- Understanding the importance of image segmentation and various methods used for segmentation, The importance of reducing the data for digital image representation by using various image compression techniques
- To understand the importance of video processing in multimedia and the various video formation models, motion estimation techniques in video processing
- Applications of motion estimation in video processing

Course Outcomes

At the end of this course, students will be able to

CO1	Know digital image, representation of digital image, importance of image resolution, applications in image processing, the advantages of representation of digital images in transform domain, application of various image transforms.
CO2	Understand and analyze the image enhancement and image degradation, image restoration techniques using spatial filters and frequency domain.
CO3	Understand and analyze the detection of point, line and edges in images, edge linking and various segmentation techniques and the redundancy in images, various image compression techniques.
CO4	Describe the video technology from analog color TV systems to digital video systems, how video signal is sampled and filtering operations in video processing.
CO5	Describe the general methodologies for 2D motion estimation, various coding used in video processing.

UNIT –I:

Fundamentals of Image Processing and Image Transforms:

Introduction, Image sampling, Quantization, Resolution, Image file formats, Elements of image processing system, Applications of Digital image processing

Introduction, Need for transform, image transforms, Fourier transform, 2 D Discrete Fourier

transform and its transforms, Importance of phase, Walsh transform, Hadamard transform, Haar transform, slant transform Discrete cosine transform, KL transform, singular value decomposition, Radon transform, comparison of different image transforms.

UNIT –II:

Image Enhancement:

Spatial domain methods: Histogram processing, Fundamentals of Spatial filtering, Smoothing spatial filters, Sharpening spatial filters.

Frequency domain methods: Basics of filtering in frequency domain, image smoothing, image sharpening, Selective filtering.

Image Restoration:

Introduction to Image restoration, Image degradation, Types of image blur, Classification of image restoration techniques, Image restoration model, Linear and Nonlinear image restoration techniques, Blind deconvolution

UNIT –III:

Image Segmentation:

Introduction to image segmentation, Point, Line and Edge Detection, Region based segmentation., Classification of segmentation techniques, Region approach to image segmentation, clustering techniques, Image segmentation based on thresholding, Edge based segmentation, Edge detection and linking, Hough transform, Active contour.

Image Compression:

Introduction, Need for image compression, Redundancy in images, Classification of redundancy in images, image compression scheme, Classification of image compression schemes, Fundamentals of information theory, Run length coding, Shannon – Fano coding, Huffman coding, Arithmetic coding, Predictive coding, Transformed based compression, Image compression standard, Wavelet-based image compression, JPEG Standards.

UNIT -IV:

Basic Steps of Video Processing:

Analog Video, Digital Video. Time-Varying Image Formation models: Three-Dimensional Motion Models, Geometric Image Formation, Photometric Image Formation, Sampling of Video signals, Filtering operations.

UNIT –V:

2-D Motion Estimation:

Optical flow, General Methodologies, Pixel Based Motion Estimation, Block- Matching Algorithm, Mesh based Motion Estimation, Global Motion Estimation, Region based Motion Estimation, Multi resolution motion estimation, Waveform based coding, Block based transform coding, Predictive coding, Application of motion estimation in Video coding.

Text Books:

1. Digital Image Processing – Gonzaleze and Woods, 3rd Ed., Pearson.
2. Video Processing and Communication – Yao Wang, Joem Ostermann and Ya–quin Zhang. 1st Ed., PH Int.
3. S. Jayaraman, S. Esakkirajan and T. Veera Kumar, "Digital Image processing, Tata McGraw Hill publishers, 2009

Reference Books:

1. Digital Image Processing and Analysis-Human and Computer Vision Application with CVIP Tools – Scotte Umbaugh, 2nd Ed, CRC Press, 2011.
2. Digital Video Processing – M. Tekalp, Prentice Hall International.
3. Multi-dimensional Signal, Image and Video Processing and Coding – John Woods, 2nd Ed, Elsevier.
4. Digital Image Processing with MATLAB and Labview – Vipula Singh, Elsevier.
5. Video Demystified – A Hand Book for the Digital Engineer – Keith Jack, 5th Ed., Elsevier.

Web References:

1. https://www.coursera.org/learn/image-processing
2. https://archive.nptel.ac.in/courses/117/105/117105135/

WIRELESS COMMUNICATIONS AND NETWORKS

Course Title: **WIRELESS COMMUNICATIONS AND NETWORKS**	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PC06
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Wireless Fundamentals, Signal Processing, Digital Communications, Network Theory, Probability and Stochastic Processes	

Course Objectives:

1. The Aim of this course is to introduce the fundamental technologies for wireless communications and networking.
2. It introduces the Key concepts of Cellular and Mobile communications.
3. Introducing the concepts of Multiple Access Schemes.
4. Introducing the important concepts of Wireless networking, WLAN, WLL, IEEE 802 standards.

Course Outcomes:

At the end of this course, students will be able to

CO1	Understand Cellular communication concepts
CO2	Study the mobile radio propagation
CO3	Study the wireless network different type of MAC protocols

UNIT -I:

The Cellular Concept-System Design Fundamentals:

Introduction, Frequency Reuse, Interference and system capacity – Co channel Interference and system capacity, Channel planning for Wireless Systems, Adjacent Channel interference , Power Control for Reducing interference, Improving Coverage & Capacity in Cellular Systems- Cell Splitting, Sectoring, Channel Assignment Strategies, Handoff Strategies- Prioritizing Handoffs, Practical Handoff Considerations, Trunking and Grade of Service

UNIT –II:

Mobile Radio Propagation: Large-Scale Path Loss:

Introduction to Radio Wave Propagation, Free Space Propagation Model, Relating Power to Electric Field, Basic Propagation Mechanisms, Reflection: Reflection from Dielectrics, Brewster Angle, Reflection from prefect conductors, Ground Reflection (Two-Ray) Model, Diffraction: Fresnel Zone Geometry, Knife-edge Diffraction Model, Multiple knife-edge Diffraction, Scattering, Outdoor Propagation Models- Longley-Ryce Model, Okumura Model, Hata Model, PCS Extension to Hata Model, Walfisch and Bertoni Model, Wideband PCS Microcell Model, Indoor Propagation Models- Partition losses (Same Floor), Partition losses between Floors, Log-distance path loss model, Ericsson Multiple Breakpoint Model, Attenuation Factor Model, Signal penetration into buildings, Ray Tracing and Site Specific Modeling.

UNIT –III:

Mobile Radio Propagation: Small –Scale Fading and Multipath

Small Scale Multipath propagation-Factors influencing small scale fading, Doppler shift, Impulse

Response Model of a multipath channel- Relationship between Bandwidth and Received power, Small- Scale Multipath Measurements-Direct RF Pulse System, Spread Spectrum Sliding Correlator Channel Sounding, Frequency Domain Channels Sounding, Parameters of Mobile Multipath Channels-Time Dispersion Parameters, Coherence Bandwidth, Doppler Spread and Coherence Time, Types of Small- Scale Fading-Fading effects Due to Multipath Time Delay Spread, Flat fading, Frequency selective fading, Fading effects Due to Doppler Spread-Fast fading, slow fading, Statistical Models for multipath Fading Channels-Clarke‟s model for flat fading, spectral shape due to Doppler spread in Clarke‟s model, Simulation of Clarke and Gans Fading Model, Level crossing and fading statistics, Two-ray Rayleigh Fading Model.

UNIT -IV:

Equalization and Diversity

Introduction, Fundamentals of Equalization, Training a Generic Adaptive Equalizer, Equalizers in a communication Receiver, Linear Equalizers, Non-linear Equalization-Decision Feedback Equalization (DFE), Maximum Likelihood Sequence Estimation (MLSE) Equalizer, Algorithms for adaptive equalization-Zero Forcing Algorithm, Least Mean Square Algorithm, Recursive least squares algorithm. Diversity -Derivation of selection Diversity improvement, Derivation of Maximal Ratio Combining improvement, Practical Space Diversity Consideration-Selection Diversity, Feedback or Scanning Diversity, Maximal Ratio Combining, Equal Gain Combining, Polarization Diversity, Frequency Diversity, Time Diversity, RAKE Receiver.

UNIT -V:

Wireless Networks

Introduction to wireless Networks, Advantages and disadvantages of Wireless Local Area Networks, WLAN Topologies, WLAN Standard IEEE 802.11, IEEE 802.11 Medium Access Control, Comparison of IEEE 802.11 a,b,g and n standards, IEEE 802.16 and its enhancements, Wireless PANs, Hiper Lan, WLL.

Text Books:

1. Wireless Communications, Principles, Practice – Theodore, S. Rappaport, 2nd Ed., 2002, PHI.
2. Wireless Communications-Andrea Goldsmith, 2005 Cambridge University Press.
3. Mobile Cellular Communication – Gottapu Sasi bhushana Rao, Pearson Education, 2012.

Reference Books:

1. Principles of Wireless Networks – KavehPahLaven and P. Krishna Murthy, 2002, PE
2. Wireless Digital Communications – KamiloFeher, 1999, PHI.
3. Wireless Communication and Networking – William Stallings, 2003, PHI.
4. Wireless Communication – UpenDalal, Oxford Univ. Press
5. Wireless Communications and Networking – Vijay K. Gary, Elsevier.

Web References:

1. https://www.sciencedirect.com/book/9780123735805/wireless-communications-and-networking
2. https://archive.nptel.ac.in/courses/117/102/117102062/

CMOS ANALOG AND DIGITAL IC DESIGN (ELECTIVE-III)

Course Title: **CMOS ANALOG AND DIGITAL IC DESIGN**	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PE03.1
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Basic Electronics, Circuit Theory, Semiconductor Physics, Digital Logic Design, Signal Processing	

Course Objectives:

1. Understand the fundamentals of CMOS technology and its applications in IC design
2. Analyze and design CMOS analog and digital circuits
3. Explore device modeling and performance optimization techniques
4. Apply principles of layout design and fabrication for ICs
5. Develop skills in simulating and testing CMOS circuits for reliability and efficiency

Course Outcomes:

At the end of this course, students will be able to

CO1	Analyze, design, optimize and simulate analog and digital circuits using CMOS constrained by the design metrics.
CO2	Connect the individual gates to form the building blocks of a system.
CO3	Use EDA tools like Cadence, Mentor Graphics and other open source software tools like Ng spice.

UNIT-I:

MOS Devices and Modeling :The MOS Transistor, Passive Components- Capacitor & Resistor, Integrated circuit Layout, CMOS Device Modeling - Simple MOS Large-Signal Model, Other Model Parameters, Small-Signal Model for the MOS Transistor, Computer Simulation Models, Sub-threshold MOS Model.

MOS Design: Pseudo NMOS Logic – Inverter, Inverter threshold voltage, output high voltage, Output Low voltage, Gain at gate threshold voltage, Transient response, Rise time, Fall time, Pseudo NMOS logic gates, Transistor equivalency, CMOS Inverter logic.

UNIT-II:

Combinational MOS Logic Circuits: MOS logic circuits with NMOS loads, Primitive CMOS logic gates– NOR & NAND gate, Complex Logic circuits design – Realizing Boolean expressions using NMOS gates and CMOS gates , AOI and OIA gates, CMOS full adder, CMOS transmission gates, Designing with Transmission gates.

Sequential MOS Logic Circuits: Behavior of bistable elements, SR Latch, Clocked latch and flip flop circuits, CMOS D latch and edge triggered flip-flop.

UNIT -III:

Dynamic Logic Circuits: Basic principle, Voltage Bootstrapping, Synchronous dynamic pass transistor circuits, Dynamic CMOS transmission gate logic, High performance Dynamic CMOS circuits.

Semiconductor Memories: Types, RAM array organization, DRAM – Types, Operation, Leakage

currents in DRAM cell and refresh operation, SRAM operation Leakage currents in SRAM cells, Flash Memory- NOR flash and NAND flash.

UNIT -IV:

Analog CMOS Sub-Circuits: MOS Switch, MOS Diode, MOS Active Resistor, Current Sinks and Sources, Current Mirrors-Current mirror with Beta Helper, Degeneration, Cascode current Mirror and Wilson Current Mirror, Current and Voltage References, Band gap Reference.

UNIT-V:

CMOS Amplifiers: Inverters, Differential Amplifiers, Cascode Amplifiers, Current Amplifiers, Output Amplifiers, High Gain Amplifiers Architectures.

CMOS Operational Amplifiers: Design of CMOS Op Amps, Compensation of Op Amps, Design of Two-Stage Op Amps, Power- Supply Rejection Ratio of Two-Stage Op Amps, Cascode Op Amps, Measurement Techniques of OP Amp.

Text Books:

1. Digital Integrated Circuit Design – Ken Martin, Oxford University Press, 2011.
2. CMOS Digital Integrated Circuits Analysis and Design – Sung-Mo Kang, Yusuf Leblebici, TMH, 3rd Ed., 2011.
3. CMOS Analog Circuit Design - Philip E. Allen and Douglas R. Holberg, Oxford University Press, International Second Edition/Indian Edition, 2010.
4. Analysis and Design of Analog Integrated Circuits- Paul R. Gray, Paul J. Hurst, S. Lewis and R.G. Meyer, Wiley India, Fifth Edition, 2010.

Reference Books:

1. Analog Integrated Circuit Design- David A. Johns, Ken Martin, Wiley Student Edn, 2016.
2. Design of Analog CMOS Integrated Circuits- Behzad Razavi, TMH Edition.
3. CMOS: Circuit Design, Layout and Simulation- Baker, Li and Boyce, PHI.
4. Digital Integrated Circuits – A Design Perspective, Jan M. Rabaey, Anantha Chandrakasan, Borivoje Nikolic, 2nd Ed., PHI.

Web References:

1. https://www.udemy.com/course/analog_ic_design_overview/?srsltid=AfmBOoroSeUkBtWSv_agaGYEz-BQDGXi8lE_TItHfQug_qFygRVJOZB4
2. https://onlinecourses.nptel.ac.in/noc21_ee09/preview

ADVANCED COMPUTER ARCHITECTURE (ELECTIVE-III)

Course Title: **ADVANCED COMPUTER ARCHITECTURE**	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PE03.2
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Digital Logic Design, Computer Organization, Microprocessors, Data Structures, Operating Systems	

Course Objectives:

- Understand the principles and performance metrics of computer architectures
- Analyze the structure and function of advanced processors and memory hierarchies
- Evaluate techniques for instruction-level and thread-level parallelism
- Explore high-performance computing concepts including multiprocessors and multithreading
- Develop skills to optimize system design for specific applications and workloads

Course Outcomes:

At the end of this course, students will be able to

CO1	Understand parallelism and pipelining concepts, the design aspects and challenges.
CO2	Evaluate the issues in vector and array processors.
CO3	Study and analyze the high performance scalable multithreaded and multiprocessor systems.

UNIT-I: Fundamentals of Computer Design:

Fundamentals of Computer design, Changing faces of computing and task of computer designer, Technology trends, Cost price and their trends, measuring and reporting performance, Quantitative principles of computer design, Amdahl's law.

Instruction set principles and examples- Introduction, classifying instruction set- memory addressing- type and size of operands, Operations in the instruction set.

UNIT-II: Pipelines:

Introduction, basic RISC instruction set, Simple implementation of RISC instruction set, Classic five stage pipe lined RISC processor, Basic performance issues in pipelining, Pipeline hazards, Reducing pipeline branch penalties.

Memory Hierarchy Design: Introduction, review of ABC of cache, Cache performance, Reducing cache miss penalty, Virtual memory.

UNIT-III:

Instruction Level Parallelism (ILP)-The Hardware Approach:Instruction-Level parallelism, Dynamic scheduling, Dynamic scheduling using Tomasulo‟s approach, Branch prediction, High performance instruction delivery- Hardware based speculation.

ILP Software Approach:Basic compiler level techniques, Static branch prediction, VLIW approach, Exploiting ILP, Parallelism at compile time, Cross cutting issues - Hardware verses Software.

UNIT-IV: Multi Processors and Thread Level Parallelism:

Multi Processors and Thread level Parallelism- Introduction, Characteristics of application domain, Systematic shared memory architecture, Distributed shared – Memory architecture, Synchronization.

UNIT-V: Inter Connection and Networks:

Introduction, Interconnection network media, Practical issues in interconnecting networks, Examples of inter connection, Cluster, Designing of clusters.

Intel Architecture: Intel IA-64 ILP in embedded and mobile markets Fallacies and pit falls.

Text Books:

1. John L. Hennessy, David A. Patterson - Computer Architecture: A Quantitative Approach, 3rd Edition, an Imprint of Elsevier.

Reference Books:

1. John P. Shen and Miikko H. Lipasti -, Modern Processor Design : Fundamentals of Super Scalar Processors
2. Computer Architecture and Parallel Processing - Kai Hwang, Faye A.Brigs., MC Graw Hill.
3. Advanced Computer Architecture - A Design Space Approach, DezsoSima, Terence Fountain, Peter Kacsuk, Pearson Ed

Web References:

1. https://onlinecourses.nptel.ac.in/noc22_cs10/preview
2. https://www.expresslibrary.mheducation.com/product/advanced-computer-architecture50173384

SOFT COMPUTING TECHNIQUES (ELECTIVE -III)

Course Title: SOFT COMPUTING TECHNIQUES	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PE03.3
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Mathematics Fundamentals, Probability and Statistics, Linear Algebra, Machine Learning Basics, Artificial Intelligence Concepts	

Course Objectives:

1. To introduce fundamental concepts and techniques in soft computing.
2. To understand and apply fuzzy logic for real-world problem solving.
3. To explore neural networks and their applications in data processing.
4. To learn genetic algorithms and their role in optimization.
5. To integrate soft computing methods for complex problem-solving.

Course Outcomes

At the end of this course the student can able to:

CO1	Understand the basic concepts of Artificial neural network systems.
CO2	Understand the McCulloch-Pitts neuron model, simple and multilayer Perception, Adeline and Madeline concepts.
CO3	Data processing, Hopfield and self-organizing network.
CO4	Difference between crisp sets to fuzzy sets, fuzzy models, fuzzification, inference,
CO5	membership functions, rule based approaches and defuzzification.
CO6	Self – organizing fuzzy logic control, non linear time delay systems.
CO7	Understand the concept of Genetic Algorithm steps. Tabu, anD-colony search techniques for solving optimization problems.
CO8	GA applications to power system optimization problems, identification and control of linear and nonlinear dynamic systems using MATLAB-Neural network toolbox.
CO9	Know the application and importance stability analysis

UNIT –I:

Introduction:

Approaches to intelligent control, Architecture for intelligent control, Symbolic reasoning system, Rule- based systems, the AI approach, Knowledge representation - Expert systems.

UNIT –II:

Artificial Neural Networks:

Concept of Artificial Neural Networks and its basic mathematical model, McCulloch-Pitts neuron model, simple perceptron, Adaline and Madaline, Feed-forward Multilayer Perceptron, Learning and Training the neural network, Data Processing: Scaling, Fourier transformation, principal-component analysis and wavelet transformations, Hopfield network, Self-organizing network and Recurrent network, Neural Network based controller.

UNIT –III:

Fuzzy Logic System:

Introduction to crisp sets and fuzzy sets, basic fuzzy set operation and approximate reasoning, Introduction to fuzzy logic modeling and control,Fuzzification, inferencing and defuzzification, Fuzzy knowledge and rule bases, Fuzzy modeling and control schemes for nonlinear systems, Self-organizing fuzzy logic control, Fuzzy logic control for nonlinear timedelay system.

UNIT –IV:

Genetic Algorithm:

Basic concept of Genetic algorithm and detail algorithmic steps, Adjustment of free parameters, Solution of typical control problems using genetic algorithm, Concept on some other search techniques like Tabu search and a D-colony search techniques for solving optimization problems.

UNIT –V:

Applications:

GA application to power system optimisation problem, Case studies: Identification and control of linear and nonlinear dynamic systems using MATLAB-Neural Network toolbox, Stability analysis of Neural- Network interconnection systems, Implementation of fuzzy logic controller using MATLAB fuzzy-logic toolbox, Stability analysis of fuzzy control systems.

Text Books:

1. Introduction to Artificial Neural Systems - Jacek.M.Zurada, Jaico Publishing House, 1999.
2. Neural Networks and Fuzzy Systems - Kosko, B., Prentice-Hall of India Pvt. Ltd., 1994.

Reference Books:

1. Fuzzy Sets, Uncertainty and Information - Klir G.J. &Folger T.A., Prentice-Hall of India Pvt. Ltd., 1993.
2. Fuzzy Set Theory and Its Applications - Zimmerman H.J. Kluwer Academic Publishers, 1994.
3. Introduction to Fuzzy Control - Driankov, Hellendroon, Narosa Publishers.
4. Artificial Neural Networks - Dr. B. Yagana narayana, 1999, PHI, New Delhi.
5. Elements of Artificial Neural Networks - KishanMehrotra, Chelkuri K. Mohan, Sanjay Ranka, Penram International.
6. Artificial Neural Network –Simon Haykin, 2nd Ed., Pearson Education.
7. Introduction Neural Networks Using MATLAB 6.0 - S.N. Shivanandam, S. Sumati, S. N. Deepa,1/e, TMH, New Delhi.

Web References:

1. https://www.sciencedirect.com/topics/computer-science/soft-computing method#:~:text=Soft%20Computing%20Method%20refers%20to,machine%20learning%2C%20and%20probability%20reasoning.
2. https://archive.nptel.ac.in/courses/106/105/106105173/

DIGITAL SIGNAL PROCESSORS AND ARCHITECTURES (ELECTIVE -IV)

Course Title: **DIGITAL SIGNAL PROCESSORS AND ARCHITECTURES**	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PE04.1
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Digital Signal Processing Fundamentals, Linear Algebra, Probability and Statistics, Electronic Circuit Design, Microprocessor Architecture	

Course Objectives:

1. To recall the digital transform techniques (Fourier and z-domain).
2. To introduce architectural features of programmable DSP Processors of Texas Instruments (TI‟s) and Analog Devices (AD‟s).
3. To give practical examples of DSP Processor architectures for better understanding.
4. To develop the programming knowledge using Instruction set of DSP Processors.
5. To understand interfacing techniques to memory and I/O devices.

Course Outcomes:

At the end of this course, students will be able to

CO1	Understand the basics concepts of Digital Signal Processing (DSP) and transforms.
CO2	To distinguish between the architectural features of General purpose processors and Programmable DSP processors.
CO3	Understand the architectures of TMS320C54xx devices.
CO4	Understand the architectures of ADSP 2100 DSP devices and Black fin Processor.
CO5	Interface various devices to DSP Processors.
CO6	Able to write simple assembly language programs using instruction set of TMS320C54xx.

UNIT –I:

Introduction to Digital Signal Processing:

Introduction, A Digital signal-processing system, The sampling process, Discrete time sequences. Discrete Fourier Transform (DFT) and Fast Fourier Transform (FFT), Linear time-invariant systems, Digital filters, Decimation and interpolation.

Computational Accuracy in DSP Implementations:

Number formats for signals and coefficients in DSP systems, Dynamic Range and Precision, Sources of error in DSP implementations, A/D Conversion errors, DSP Computational errors, D/A Conversion Errors, Compensating filter.

UNIT –II:

Architectures for Programmable DSP Devices:

Basic Architectural features, DSP Computational Building Blocks, Bus Architecture and Memory, Data Addressing Capabilities, Address Generation UNIT, Programmability and Program Execution, Speed Issues, Features for External interfacing.

UNIT -III:

Programmable Digital Signal Processors:

Commercial Digital signal-processing Devices, Data Addressing modes of TMS320C54XX DSPs, Data Addressing modes of TMS320C54XX Processors, Memory space of TMS320C54XX Processors, Program Control, TMS320C54XX instructions and Programming, On-Chip Peripherals, Interrupts of TMS320C54XX processors, Pipeline operation of TMS320C54XX Processors.

UNIT –IV:

Analog Devices Family of DSP Devices:

Analog Devices Family of DSP Devices – ALU and MAC block diagram, Shifter Instruction, Base Architecture of ADSP 2100, ADSP-2181 high performance Processor.

Introduction to Blackfin Processor - The Blackfin Processor, Introduction to Micro Signal Architecture, Overview of Hardware Processing Units and Register files, Address Arithmetic Unit, Control Unit, Bus Architecture and Memory, Basic Peripherals.

UNIT –V:

Interfacing Memory and I/O Peripherals to Programmable DSP Devices:

Memory space organization, External bus interfacing signals, Memory interface, Parallel I/O interface, Programmed I/O, Interrupts and I/O, Direct memory access (DMA).

Text Books:

1. Digital Signal Processing – Avtar Singh and S. Srinivasan, Thomson Publications, 2004.
2. A Practical Approach to Digital Signal Processing - K Padmanabhan, R. Vijayarajeswaran, Ananthi. S, New Age International, 2006/2009
3. EmbeddedSignalProcessingwiththeMicroSignalArchitecturePublisher: Woon-SengGan, Sen M. Kuo, Wiley-IEEE Press, 2007

Reference Books:

1. Digital Signal Processors, Architecture, Programming and Applications – B. Venkataramani and M. Bhaskar, 2002, TMH.
2. Digital Signal Processing –Jonatham Stein, 2005, John Wiley.
3. DSP Processor Fundamentals, Architectures & Features – Lapsley et al. 2000, S. Chand & Co.
4. Digital Signal Processing Applications Using the ADSP-2100 Family by The Applications Engineering Staff of Analog Devices, DSP Division, Edited by Amy Mar, PHI
5. The Scientist and Engineer's Guide to Digital Signal Processing by Steven W. Smith, Ph.D., California Technical Publishing, ISBN 0-9660176-3-3, 1997
6. Embedded Media Processing by David J. Katz and Rick Gentile of Analog Devices, Newnes , ISBN 0750679123, 2005

ELECTROMAGNETIC INTERFERENCE AND ELECTROMAGNETIC COMPATIBILITY (EMI / EMC)
(ELECTIVE-IV)

Course Title: **(EMI / EMC)**	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PE04.2
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Electromagnetic Theory, Circuit Analysis, Signal Processing, Materials Science, Electromagnetic Field Measurement	

Course objectives:

1. To introduce enough knowledge regarding the Electromagnetic interference/ Electromagnetic compatibility, Its practical experiences and concerns, and various sources both the natural and Nuclear sources of EMI.
2. To know the practical experiences due to EMI such as mains power supply, switches and relaysetc and Analyze EM Propagation and Crosstalk
3. To know various methods of the measurements radiated and conducted interference in open area test sites and in chambers.
4. To Learn about the various methods of minimizing the EMI.
5. To know the National/International EMC Standards.

Course outcomes

At the end of this course the student can able to:

CO1	Understand the electromagnetic environment the definitions of EMI and EMC, history of EMI some examples of practical experiences due to EMI such as mains power supply, switches and relays etc.
CO2	Understand the celestial electromagnetic noise the occurrence of lightning discharge and their effects, the charge accumulation and discharge in an electrostatic discharge, model ESD wave form, the various cases of nuclear explosion and the transients.
CO3	Understand the methods to measure RE and RS in the open are test sites
CO4	Understand the measurement facilities and procedures using anechoic chamber, TEM cell, reverberating chamber GTEM cell.

UNIT -I:

Introduction, Natural and Nuclear Sources of EMI / EMC:Electromagnetic environment, History, Concepts, Practical experiences and concerns, frequency spectrum conservations, An overview of EMI / EMC, Natural and Nuclear sources of EMI.

UNIT -II:

EMI from Apparatus, Circuits and Open Area Test Sites:Electromagnetic emissions, Noise from relays and switches, Non-linearities in circuits, passive intermodulation, Cross talk in transmission lines, Transients in power supply lines, Electromagnetic interference (EMI), Open area test sites and measurements.

UNIT -III:

Radiated and Conducted Interference Measurements and ESD:Anechoic chamber, TEM cell, GH TEM Cell, Characterization of conduction currents / voltages, Conducted EM noise on power lines, Conducted EMI from equipment, Immunity to conducted EMI detectors and measurements, ESD, Electrical fast transients / bursts, Electrical surges.

UNIT -IV:

Grounding, Shielding, Bonding and EMI filters:Principles and types of grounding, Shielding and bonding, Characterization of filters, Power lines filter design.

UNIT -V:

Cables, Connectors, Components and EMC Standards:

EMI suppression cables, EMC connectors, EMC gaskets, Isolation transformers, optoisolators, National / International EMC standards.

Text Books:

1. Engineering Electromagnetic Compatibility - Dr. V.P. Kodali, IEEEPublication, Printed in India by S. Chand & Co. Ltd., New Delhi, 2000.
2. Electromagnetic Interference and Compatibility IMPACTseries,IIT – Delhi, Modules 1-9

Reference Books:

1. Introduction to Electromagnetic Compatibility - Ny, John Wiley, 1992, by C.R. Pal.

OBJECT ORIENTED PROGRAMMING
(ELECTIVE IV)

Course Title: OBJECT ORIENTED PROGRAMMING	I Year- II Semester
Teaching Scheme (L:T:P): 3:0:0	Course Code: 2438PE04.3
Type of Course: Lecture	Credits: 3
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites: Basic Programming Concepts, Data Structures, Algorithms, Problem-Solving Techniques, Knowledge of a Programming Language (e.g., C++, Java, Python)	

Course Objectives:

The main objectives of this course are given below:

- Its main objective is to teach the basic concepts and techniques and java program structure which form the object oriented programming paradigm

Course Outcomes:

At the end of this course the student can able to:

CO1	The model of object oriented programming: abstract data types, encapsulation, inheritance and polymorphism
CO2	Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections
CO3	How to take the statement of a business problem and from this determine suitable logic for solving the problem; then be able to proceed to code that logic as a program written in Java.
CO4	How to test, document and prepare a professional looking package for each business project using java doc

UNIT I:

Objective: Focus on object oriented concepts and java program structure and its installation

Introduction to OOP

Introduction, Need of Object Oriented Programming, Principles of Object Oriented Languages, Procedural languages Vs OOP, Applications of OOP, History of JAVA, Java Virtual Machine, Java Features, Installation of JDK1.6

UNIT II:

Objective: Comprehension of java programming constructs, control structures in Java Programming Constructs

Variables , Primitive Datatypes, Identifiers- Naming Conventions, Keywords, Literals, Operators-Binary, Unary and ternary, Expressions, Precedence rules and Associativity, Primitive Type Conversion and Casting, Flow of control-Branching, Conditional, loops.,

Classes and Objects- classes, Objects, Creating Objects, Methods, constructors-Constructor overloading, Garbage collector, Class variable and Methods-Static keyword, this keyword, Arrays, Command line arguments

UNIT III:

Objective: Implementing Object oriented constructs such as various class hierarchies, interfaces and

exception handling
Inheritance: Types of Inheritance, Deriving classes using extends keyword, Method overloading, super keyword, final keyword, Abstract class
Interfaces, Packages and Enumeration: Interface-Extending interface, Interface Vs Abstract classes, Packages-Creating packages , using Packages, Access protection, java.lang package
Exceptions & Assertions - Introduction, Exception handling techniques-try...catch, throw, throws, finally block, user defined exception, Assertions

UNIT IV:
Objective: Understanding of Thread concepts and I/O in Java
MultiThreading :java.lang.Thread, The main Thread, Creation of new threads, Thread priority, Multithreading, Syncronization, suspending and Resuming threads, Communication between Threads Input/Output: reading and writing data, java.io package.

UNIT V:
Objective: Being able to build dynamic user interfaces using applets and Event handling in java
Applets- Applet class, Applet structure, An Example Applet Program, Applet Life Cycle, paint(),update() and repaint()
Event Handling -Introduction, Event Delegation Model, java.awt.event Description, Event Listeners, Adapter classes, Inner classes
Understanding of various components of Java AWT and Swing and writing code snippets using them
Abstract Window Toolkit
Why AWT?, java.awt package, Components and Containers, Button, Label, Checkbox, Radio buttons, List boxes, Choice boxes, Text field and Text area, container classes, Layouts, Menu, Scroll bar Swing:Introduction , JFrame, JApplet, JPanel, Components in swings, Layout Managers, JList and JScroll Pane, Split Pane, JTabbedPane, Dialog Box

Text Books:
1. The Complete Refernce Java, 8ed, Herbert Schildt, TMH
2. Programming in JAVA, Sachin Malhotra, Saurabhchoudhary, Oxford.
3. JAVA for Beginners, 4e, Joyce Farrell, Ankit R. Bhavsar, Cengage Learning.
4. Object oriented programming with JAVA, Essentials and Applications, RajKumar Bhuyya, Selvi, Chu TMH
5. Introduction to Java rogramming, 7thed, Y Daniel Liang, Pearson

Reference Books:
1. JAVA Programming, K.Rajkumar.Pearson
2. Core JAVA, Black Book, NageswaraRao, Wiley, Dream Tech
3. Core JAVA for Beginners, RashmiKanta Das, Vikas.
4. Object Oriented Programming through JAVA , P Radha Krishna , University Press.

Web References:
1. https://www.geeksforgeeks.org/introduction-of-object-oriented-programming/
2. https://archive.nptel.ac.in/courses/106/105/106105153/

ADVANCED COMMUNICATIONS LAB

Course Title: ADVANCED COMMUNICATIONS LAB	I Year- II Semester
Teaching Scheme (L:T:P): 0:0:4	Course Code: 2438PC07
Type of Course: Practicals	Credits: 2
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites:	

Course Objectives:

1. To provide hands-on experience with advanced communication systems and techniques.
2. To develop skills in designing and analyzing communication circuits and networks.
3. To enhance the understanding of modern communication protocols and their applications in real-world scenarios.

Course Outcomes:

At the end of this course, students will be able to

CO1	Identify the different types of network devices and their functions within a network.
CO2	Understand and build the skills of sub-netting and routing mechanisms.
CO3	Understand basic protocols of computer networks, and how they can be used to assist in network design and implementation.

Note:

A. Minimum of 10 Experiments have to be conducted

B. All Experiments may be Simulated using MATLAB and to be verified using related training kits.

1. Measurement of Bit Error Rate using Binary Data
2. Verification of minimum distance in Hamming code
3. Determination of output of Convolutional Encoder for a given sequence
4. Determination of output of Convolutional Decoder for a given sequence
5. Efficiency of DS Spread- Spectrum Technique
6. Simulation of Frequency Hopping (FH) system
7. Effect of Sampling and Quantization of Digital Image
8. Verification of Various Transforms (FT / DCT/ Walsh / Hadamard) on a given Image (Finding Transform and Inverse Transform)
9. Point, Line and Edge detection techniques using derivative operators.
10. Implementation of FIR filter using DSP Trainer Kit (C-Code/ Assembly code)
11. Implementation of IIR filter using DSP Trainer Kit (C-Code/ Assembly code)
12. Determination of Losses in Optical Fiber
13. Observing the Waveforms at various test points of a mobile phone using Mobile Phone Trainer
14. Study of Direct Sequence Spread Spectrum Modulation & Demodulation using CDMA-DSS-BER Trainer
15. Study of ISDN Training System with Protocol Analyzer
16. Characteristics of LASER Diode.

ADVANCED DIGITAL IMAGE AND VIDEO PROCESSING LAB

Course Title: ADVANCED DIGITAL IMAGE AND VIDEO PROCESSING LAB	I Year- II Semester
Teaching Scheme (L:T:P): 0:0:4	Course Code: 2438PC08
Type of Course: Practicals	Credits: 2
Continuous Internal Evaluation: 25 Marks	Semester End Exam: 75 Marks
Pre-requisites:	

Course Objectives:

1. To understand and implement advanced image and video processing techniques for real-world applications.
2. To develop practical skills in using software tools and programming languages for processing and analyzing digital images and videos.
3. To explore and apply various algorithms in image enhancement, restoration, compression, and video analysis.

Course Outcomes:

At the end of this course, students will be able to

CO1	Perform and analyze image and video enhancement and restoration
CO2	Perform and analyze image and video segmentation and compression
CO3	work and process viz., detection, extraction on the image/video

List of Experiments:

1. Perform basic operations on images like addition, subtraction etc.
2. Plot the histogram of an image and perform histogram equalization
3. Implement segmentation algorithms
4. Perform video enhancement
5. Perform video segmentation
6. Perform image compression using lossy technique
7. Perform image compression using lossless technique
8. Perform image restoration
9. Convert a colour model into another
10. Calculate boundary features of an image
11. Calculate regional features of an image
12. Detect an object in an image/video using template matching/Bayes classifier

MINI PROJECT

Course Title: **Mini Project**	I Year- II Semester
Teaching Scheme (L:T:P): 0:0:4	Course Code: 2438PR01
Type of Course: Practicals	Credits: 2
Continuous Internal Evaluation: 100 Marks	Semester End Exam: 0 Marks
Pre-requisites:	

Syllabus Contents

The students are required to search / gather the material / information on a specific a topic comprehend it and present / discuss in the class.

Course Outcomes

At the end of this course, students will be able to

1. Understand of contemporary / emerging technology for various processes and systems.
2. Share knowledge effectively in oral and written form and formulate documents

VALUE EDUCATION

Course Title: VALUE EDUCATION	**I Year- II Semester**
Teaching Scheme (L:T:P): 2:0:0	Course Code: 2438AC02.1
Type of Course: Lecture	Credits: 0
Continuous Internal Evaluation: 0 Marks	Semester End Exam: 0 Marks
Pre requisites: Awareness of Personal Values, Understanding of Ethical Principles, Empathy and Compassion, Critical Thinking Skills, Commitment to Lifelong Learning.	

Course Objectives

Students will be able to

1. Understand value of education and self- development
2. Imbibe good values in students
3. Let the should know about the importance of character

Course outcomes

Students will be able to

CO1	Knowledge of self-development
CO2	Learn the importance of Human values
CO3	Developing the overall personality

Syllabus

Unit-1

Values and self-development

Social values and individual attitudes. Work ethics, Indian vision of humanism, Moral and non-moral valuation. Standards and principles, Value judgements.

Unit-2

Importance of cultivation of values.

Sense of duty. Devotion, Self-reliance. Confidence, Concentration. Truthfulness, Cleanliness, Honesty, Humanity. Power of faith, National Unity, Patriotism, Love for nature ,Discipline.

Unit-3

Personality and Behavior Development

Soul and Scientific attitude. Positive Thinking. Integrity and discipline. Punctuality, Love and Kindness, Avoid fault Thinking, Free from anger, Dignity of labor, Universal brotherhood and religious tolerance, True friendship, Happiness Vs suffering, love for truth, Aware of self-destructive habits, Association and Cooperation, Doing best for saving nature. Character and Competence –Holy books vs Blind faith, Self-management and Good health, Science of reincarnation, Equality, Nonviolence ,Humility, Role of Women. All religions and same message. Mind your Mind, Self-control. Honesty, Studying effectively

1 Chakraborty, S.K. “Values and Ethics for organizations Theory and practice”, Oxford University Press, New Delhi

CONSTITUTION OF INDIA

Course Title: CONSTITUTION OF INDIA	**I Year- II Semester**
Teaching Scheme (L:T:P): 2:0:0	Course Code: 2438AC02.2
Type of Course: Lecture	Credits: 0
Continuous Internal Evaluation: 0 Marks	Semester End Exam: 0 Marks
Pre requisites: Preamble, Fundamental Rights, Directive Principles of State Policy, Fundamental Duties, Amendment Procedure.	

Course Objectives:

Students will be able to:

1. Understand the premises informing the twin themes of liberty and freedom from a civil rights perspective.
2. To address the growth of Indian opinion regarding modern Indian intellectuals‟ constitutional role and entitlement to civil and economic rights as well as the emergence of nationhood in the early years of Indian nationalism.
3. To address the role of socialism in India after the commencement of the Bolshevik Revolution in 1917 and its impact on the initial drafting of the Indian Constitution.

Course Outcomes:

CO1	Discuss the growth of the demand for civil rights in India for the bulk of Indians before the arrival of Gandhi in Indian politics.
CO2	Discuss the intellectual origins of the framework of argument that informed the conceptualization of social reforms leading to revolution in India.
CO3	Discuss the circumstances surrounding the foundation of the Congress Socialist Party [CSP] under the leadership of Jawaharlal Nehru and the eventual failure of the proposal of direct elections through adult suffrage in the Indian Constitution.
CO4	Discuss the passage of the Hindu Code Bill of 1956.

Syllabus

Unit-1

History of Making of the Indian Constitution: History, Drafting Committee, (Composition & Working)

Unit-2

Philosophy of the Indian Constitution, Preamble Salient Features

Contours of Constitutional Rights & Duties:

Fundamental Rights Right to Equality Right to Freedom. Right against Exploitation Right to Freedom of Religion Cultural and Educational Rights. Right to Constitutional Remedies Directive Principles of State Policy Fundamental Duties.

Unit-3

Organs of Governance: Parliament Composition, Qualifications and Disqualifications Powers and Functions Executive President Governor, Council of Ministers, Judiciary, Appointment and Transfer of Judges, Qualifications Powers and Functions.

Unit-4

Local Administration:

District's Administration head: Role and Importance, Municipalities: Introduction, Mayor and role of Elected Representative, CE of Municipal Corporation. Panchayat raj: Introduction, PRI: Zila Panchayat. Elected officials and their roles, CEO Zila Panchayat: Position and role. Block level: Organizational Hierarchy (Different departments), Village level: Role of Elected and Appointed officials, Importance of grass root democracy

Unit-5

Election Commission: Role and Functioning. Chief Election Commissioner and Election Commissioners. State Election Commission: Role and Functioning. Institute and Bodies for the welfare of SC/ST/OBC and women.

References:

1. The Constitution of India, 1950 (Bare Act), Government Publication.
2. Dr. S. N. Busi, Dr. B. R. Ambedkar framing of Indian Constitution, 1st Edition, 2015.
3. M. P. Jain, Indian Constitution Law, 7th Edn., Lexis Nexis, 2014.
4. D.D. Basu, Introduction to the Constitution of India, Lexis Nexis, 2015.

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Department of ELECTRONICS AND COMMUNICATION ENGINEERING

Program: M.Tech- DECS **Regulation: R24**

I Year I Semester- Course Structure

S.No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	PC	R2438PC01	Digital System Design	3	0	0	3
2	PC	R2438PC02	Digital Data Communications	3	0	0	3
3	PE	**Professional Elective I**		3	0	0	3
		R2438PE01.1	1. Transform Techniques				
		R2438PE01.2	2. VLSI Technology and Design				
		R2438PE01.3	3. Radar Signal Processing				
4	PE	**Professional Elective II**		3	0	0	3
		R2438PE02.1	1. Statistical Signal Processing				
		R2438PE02.2	2. Optical Communication Technology				
		R2438PE02.3	3. Network Security & Cryptography				
5	PC	R2438PC03	System Design Using Verilog HDL Laboratory	0	0	4	2
6	PC	R2438PC04	Data Communications Laboratory	0	0	4	2
7	MC	R2438MTMC01	Research Methodology and IPR	2	0	0	2
8	AC	**Audit Course 1**		2	0	0	0
		R2438AC01.1	1. English for Research paper writing				
		R2438AC01.2	2. Disaster Management				
Total				16	0	8	18

Category	Courses	Credits
PC- Professional Core Course	4	10
PE- Professional Elective	2	6
MC-Mandatory Course	1	2
AC- Audit Course	1	0
Total	**8**	**18**

Department of ELECTRONICS AND COMMUNICATION ENGINEERING

Program: M.Tech-DECS **Regulation: R24**

I Year II Semester- Course Structure

S.No	Category	Course Code	Course Title	Hours per Week			
				L	T	P	Credits
1	**PC**	**R2438PC05**	Image and Video Processing	3	0	0	3
2	**PC**	**R2438PC06**	Wireless Communications and Networks	3	0	0	3
3	**PE**	**Professional Elective III**		3	0	0	3
		R2438PE03.1	**1.** CMOS Analog & Digital IC Design				
		R2438PE03.2	**2.** Advanced Computer Architecture				
		R2438PE03.3	3. Soft Computing Techniques				
4	**PE**	**Professional Elective IV**		3	0	0	3
		R2438PE04.1	**1.** DSP Processors and Architectures				
		R2438PE04.2	2. EMI/ EMC				
		R2438PE04.3	3. Object Oriented Programming				
5	**PC**	**R2438PC07**	Advanced Communications Laboratory	0	0	4	2
6	**PC**	**R2438PC08**	Advanced digital Image processing Laboratory	0	0	4	2
7	**PR**	**R2438PR01**	Mini Project (Seminar)	0	0	4	2
8	**AC**	**Audit Course 2**		2	0	0	0
		R2438AC02.1	1. Constitution of India				
		R2438AC02.2	2. Value Education				
Total				14	0	12	18

*Students be encouraged to go to Industrial Training/Internship for at least 2-3 weeks during semester break.

Category	Courses	Credits
PC- Professional Core Course	4	10
PE- Professional Elective	2	6
PR-Mini Project	1	2
AC- Audit Course	1	0
Total	**8**	**18**

Department of ELECTRONICS AND COMMUNICATION ENGINEERING

Program: M.Tech- DECS **Regulation: R24**

II Year I Semester- Course Structure

S. No.	Category	Course Type/Code	Subject	Teaching Scheme			Credits
				L	T	P	
1	PE	**R2438PE05.1** **R2438PE05.2** **R2438PE05.3**	a) Detection & Estimation Theory b) Advanced Digital Signal Processing c) Coding Theory and Applications	3	0	0	3
2	OE	**R2438OE01.1** **R2438OE01.2** **R2438OE01.3** **R2438OE01.4** **R2438OE01.5** **R2438OE01.6**	a) Business Analytics b) Industrial Safety c) Operations Research d) Cost Management of Engineering Projects e) Composite Materials f) Waste to Energy	3	0	0	3
3	DP	**R2438DP01**	Dissertation Phase – I	0	0	20	10
		Total		**6**	**0**	**20**	**16**

Category	Courses	Credits
PE- Professional Elective	1	3
OE- Open Elective	1	3
DP- Dissertation Phase-I	1	10
Total	**3**	**16**

II Year II Semester- Course Structure

S. No.	Category	Course Type/Code	Subject	Teaching Scheme			Credits
				L	T	P	
1	DP	**R2438DP02**	Dissertation Phase – II	0	0	32	16
		Total		**0**	**0**	**32**	**16**

Course Title: DETECTION & ESTIMATION THEORY	**Course Code: R2438PE05.1**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 03
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Detection & Estimation theory, students should have a solid understanding of probability theory and random processes is essential to grasp statistical signal analysis, linear algebra and signals & systems is also helpful for modeling and solving estimation problems.	

Course Objectives:

1. Understand and analyze various random processes including Markov and Gaussian processes for signal modeling.
2. Apply detection theory principles to solve decision-making problems under uncertainty.
3. Design and evaluate minimum mean-square error estimators, including Wiener and Kalman filters.
4. Develop and assess statistical estimators and hypothesis tests for parameter inference.
5. Estimate parameters and properties of random processes using both model-free and model-based techniques.

Course Outcomes:

At the end of this course, students will be able to

Course Outcome (CO)	PO1	PO2	PO3	PO4	PO5	PO11	PSO1	BT LEVEL
CO1: Apply fundamental concepts of random processes including Markov and Gaussian processes to analyze signals and systems.	3	2	–	–	–	–		L4
CO2: Evaluate and implement optimal detection strategies using MAP, Bayes, and Neyman-Pearson criteria for signal classification.	3	3	–	2	–	–		L3
CO3: Design and analyze Wiener and Kalman filters for linear and nonlinear estimation problems.	3	2	3	–	3	–		L6
CO4: Apply statistical techniques for estimation of distributions, parameters, and hypothesis testing in signal processing tasks.	3	2	–	3	–	2		L5
CO5: Analyze and estimate parameters of random processes using both model-based and model-free methods for engineering applications.	3	3	2	2	2	2		L5

UNIT –I:

Random Processes: Discrete Linear Models, Markov Sequences and Processes, Point Processes, and Gaussian Processes. **COs-CO1**

UNIT –II:

Detection Theory: Basic Detection Problem, Maximum A posteriori Decision Rule, Minimum Probability of Error Classifier, Bayes Decision Rule, Multiple-Class Problem (Bayes)- minimum probability error with and without equal a priori probabilities, Neyman-Pearson Classifier, General Calculation of Probability of Error, General Gaussian Problem, Composite Hypotheses. **COs-CO2**

UNIT –III:

Linear Minimum Mean-Square Error Filtering: Linear Minimum Mean Squared Error Estimators, Nonlinear Minimum Mean Squared Error Estimators. Innovations, Digital Wiener Filters with Stored Data, Real-time Digital Wiener Filters, Kalman Filters. **COs-CO3**

UNIT –IV:

Statistics: Measurements, Nonparametric Estimators of Probability Distribution and Density Functions, Point Estimators of Parameters, Measures of the Quality of Estimators, Introduction to Interval Estimates, Distribution of Estimators, Tests of Hypotheses, Simple Linear Regression, Multiple Linear Regression. **COs-CO4**

UNIT –V:

Estimating the Parameters of Random Processes from Data: Tests for Stationarity and Ergodicity, Model-free Estimation, Model-based Estimation of Autocorrelation Functions, Power Special Density Functions. **COs-CO5**

TEXT BOOKS:

1. Random Signals: Detection, Estimation and Data Analysis - K. Sam Shanmugan& A.M. Breipohl, Wiley India Pvt. Ltd, 2011.
2. Random Processes: Filtering, Estimation and Detection - Lonnie C. Ludeman, Wiley India Pvt. Ltd., 2010

REFERENCE BOOKS:

1. Fundamentals of Statistical Signal Processing: Volume I Estimation Theory– Steven.M.Kay, Prentice Hall, USA, 1998.
2. Fundamentals of Statistical Signal Processing: Volume I Detection Theory– Steven.M.Kay, Prentice Hall, USA, 1998.
3. Introduction to Statistical Signal Processing with Applications - Srinath, Rajasekaran, Viswanathan, 2003, PHI.
4. Statistical Signal Processing: Detection, Estimation and Time Series Analysis – Louis L.Scharf, 1991, Addison Wesley.
5. Detection, Estimation and Modulation Theory: Part – I – Harry L. Van Trees, 2001, John Wiley & Sons, USA.
6. Signal Processing: Discrete Spectral Analysis – Detection & Estimation – Mischa Schwartz, Leonard Shaw, 1975, McGraw Hill.

Course Title: ADVANCED DIGITAL SIGNAL PROCESSING	**Course Code: R2438PE05.2**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 03
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Advanced Digital Signal Processing, students should have a solid understanding of Digital Signal Processing, Linear Algebra, and Probability Theory.	

Course Objectives:

1. To review foundational DSP concepts including DFT, FFT, IIR, and FIR filters.
2. To understand the principles and design of multirate signal processing systems.
3. To explore practical applications of multirate processing in digital communication and filtering.
4. To learn and compare non-parametric and parametric power spectral estimation methods.
5. To study advanced filter structures and the effects of finite word-length in DSP implementations.

Course Outcomes:

At the end of this course, students will be able to

COs	PO1	PO2	PO3	PO4	PO5	PO11	PSO1	BT LEVEL
CO1: Analyze and apply DFT, FFT, FIR, and IIR filter concepts for advanced signal processing tasks.	3	2	–	–	2	–		
CO2: Design and implement multirate signal processing operations like decimation, interpolation, and sampling rate conversion.	3	2	3	–	3	2		
CO3: Apply multirate processing techniques to real-world applications such as sub-band coding, filter banks, and oversampling converters.	3	2	2	–	3	2		
CO4: Evaluate non-parametric and parametric spectral estimation methods and compare their performance for different signal scenarios.	3	3	–	2	2	2		
CO5: Analyze and implement advanced digital filter structures including lattice and frequency sampling forms considering finite word-length effects.	3	2	3	2	3	2		

SYLLABUS

UNIT –I:

Review of DFT, FFT, IIR Filters and FIR Filters:

Multi Rate Signal Processing: Introduction, Decimation by a factor D, Interpolation by a factor I, Sampling rate conversion by a rational factor I/D, Multistage Implementation of Sampling Rate Conversion, Filter design & Implementation for sampling rate conversion. **COs-CO1**

UNIT –II:

Applications of Multi Rate Signal Processing: Design of Phase Shifters, Interfacing of Digital Systems with Different Sampling Rates, Implementation of Narrow Band Low Pass Filters, Implementation of Digital Filter Banks, Sub-band Coding of Speech Signals, Quadrature Mirror

Filters, Trans-multiplexers, Over Sampling A/D and D/A Conversion. **COs-CO2**

UNIT -III:

Non-Parametric Methods of Power Spectral Estimation: Estimation of spectra from finite duration observation of signals, Non-parametric Methods: Bartlett, Welch & Blackman-Tukey methods, Comparison of all Non-Parametric methods. **COs-CO3**

UNIT –IV:

Implementation of Digital Filters: Introduction to filter structures (IIR & FIR), Frequency sampling structures of FIR, Lattice structures, Forward prediction error, Backward prediction error, Reflection coefficients for lattice realization, Implementation of lattice structures for IIR filters, Advantages of lattice structures. **COs-CO4**

UNIT –V:

Parametric Methods of Power Spectrum Estimation: Autocorrelation & Its Properties,Relation between auto correlation & model parameters, AR Models - Yule-Walker & Burg Methods, MA & ARMA models for power spectrum estimation, Finite word length effect in IIR digital Filters – Finite word-length effects in FFT algorithms. **COs-CO5**

TEXT BOOKS:

1. Digital Signal Processing: Principles, Algorithms & Applications - J.G.Proakis& D. G. Manolakis, 4th Ed., PHI.
2. Discrete Time Signal Processing - Alan V Oppenheim & R. W Schaffer, PHI.
3. DSP – A Practical Approach – Emmanuel C. Ifeacher, Barrie. W. Jervis, 2 Ed., Pearson Education.

REFERENCE BOOKS:

1. Modern Spectral Estimation: Theory & Application – S. M .Kay, 1988, PHI.
2. Multi Rate Systems and Filter Banks – P.P.Vaidyanathan – Pearson Education.
3. Digital Signal Processing – S.Salivahanan, A.Vallavaraj, C.Gnanapriya, 2000,TMH
4. Digital Spectral Analysis – Jr. Marple

Course Title: CODING THEORY AND APPLICATIONS	**Course Code: R2438PE05.3**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 03
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Coding Theory and Applications, students should have a solid understanding of linear algebra, probability theory, and digital communication systems.	

Course Objectives

1. To introduce the mathematical foundation of information theory and error control coding.
2. To analyze the construction and decoding of linear block codes and cyclic codes.
3. To study the structure and applications of convolutional codes with decoding algorithms.
4. To understand the correction of burst errors using cyclic and convolutional codes.
5. To explore BCH codes and their decoding techniques for practical communication systems.

Course Outcomes:

At the end of the course, students will able to,

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO9	PO10	PO11	PSO1	BT Level
CO1: Apply the fundamental concepts of information theory, entropy, mutual information, and basic error control strategies in digital communication and storage systems.	3	2	–	–	2	–	–	–		L3
CO2: Analyze linear block codes and perform syndrome-based error detection and correction for reliable data transmission.	3	3	2	2	2	–	–	–		L4
CO3: Design and decode cyclic codes using generator matrices, syndrome computation, and majority logic decoding techniques.	3	3	2	2	3	–	–	–		L4
CO4: Apply convolutional coding and implement decoding techniques such as Viterbi and sequential decoding in communication systems and ARQ protocols.	3	3	3	3	3	2	2	–		L5
CO5: Evaluate burst-error and BCH codes, and implement iterative decoding for correcting single and multiple errors in digital systems.	3	3	3	3	3	2	2	2		L5

SYLLABUS

UNIT –I:

Coding for Reliable Digital Transmission and Storage: Mathematical model of Information, A ogarithmic Measure of Information, Average and Mutual Information and Entropy, Types of Errors, Error Control Strategies.

Linear Block Codes: Introduction to Linear Block Codes, Syndrome and Error Detection, Minimum Distance of a Block code, Error-Detecting and Error-correcting Capabilities of a Block code, Standard array and Syndrome Decoding, Probability of an undetected error for Linear Codes over a BSC, Hamming Codes. Applications of Block codes for Error control in data storage system. **COs-CO1**

UNIT –II:

Cyclic Codes: Description, Generator and Parity-check Matrices, Encoding, Syndrome Computation and Error Detection, Decoding ,Cyclic Hamming Codes, Shortened cyclic codes, Error-trapping decoding for cyclic codes, Majority logic decoding for cyclic codes. **COs-CO2**

UNIT –III:

Convolutional Codes: Encoding of Convolutional Codes, Structural and Distance Properties, maximum likelihood decoding, Sequential decoding, Majority- logic decoding of Convolution codes. Application of Viterbi Decoding and Sequential Decoding, Applications of Convolutional codes in ARQ system. **COs-CO3**

UNIT –IV:

Burst –Error-Correcting Codes: Decoding of Single-Burst error Correcting Cyclic codes, Single-Burst-Error-Correcting Cyclic codes, Burst-Error-Correcting Convolutional Codes, Bounds on Burst Error-Correcting Capability, Interleaved Cyclic and Convolutional Codes, Phased-Burst –Error-Correcting Cyclic and Convolutional codes. **COs-CO4**

UNIT -V:

BCH – Codes: BCH code- Definition, Minimum distance and BCH Bounds, Decoding Procedure for BCH Codes- Syndrome Computation and Iterative Algorithms, Error Location Polynomials and Numbers for single and double error correction **COs-CO5**

TEXT BOOKS:

1. Error Control Coding- Fundamentals and Applications –Shu Lin, Daniel J.Costello,Jr, Prentice Hall, Inc.
2. Error Correcting Coding Theory-Man Young Rhee- 1989, McGraw-Hill Publishing.

REFERENCE BOOKS:

1. Digital Communications-Fundamental and Application - Bernard Sklar, PE.
2. Digital Communications- John G. Proakis, 5th Ed., 2008, TMH.
3. Introduction to Error Control Codes-Salvatore Gravano-oxford
4. Error Correction Coding – Mathematical Methods and Algorithms – Todd K.Moon, 2006, Wiley India.
5. Information Theory, Coding and Cryptography – Ranjan Bose, 2nd Ed, 2009, TMH.

Course Title: BUSINESS ANALYTICS	**Course Code: R2438OE01.1**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 03
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Business Analytics, students should have a solid understanding of statistics, probability, and data interpretation, along with fundamental programming or spreadsheet skills.	

Course Objectives:

1. To introduce the fundamentals, scope, and competitive importance of Business Analytics.
2. To equip students with statistical and regression tools for data-driven decision-making.
3. To explain the organizational and management aspects involved in business analytics projects.
4. To familiarize learners with forecasting, simulation models, and risk analysis techniques.
5. To develop skills in decision analysis, data storytelling, and current trends in analytics.

Course Outcomes:

At the end of the course, students will able to,

Course Outcome	PO1	PO2	PO3	PO4	PO5	PO6	PO8	PO9	PO10	PSO1	BT Level
CO1: Understand the scope, process, and strategic role of business analytics in gaining competitive advantage.	3	2	–	–	–	2	–	–	–	–	L2
CO2: Apply statistical tools and regression techniques for analyzing business data and uncovering trends.	3	3	–	2	2	–	–	–	–	–	L3
CO3: Analyze organizational structures, data management policies, and change management practices in analytics projects.	3	3	2	–	2	2	2	2	2	–	L4
CO4: Use forecasting models, Monte Carlo simulations, and risk analysis techniques for business decision-making.	3	3	3	3	3	–	–	–	–	–	L5
CO5: Evaluate decision problems using decision trees, utility theory, and explore current trends such as data storytelling and embedded analytics.	3	2	3	3	2	–	2	3	2	2	L5

UNIT I:

Business analytics: Overview of Business analytics, Scope of Business analytics, Business Analytics Process, Relationship of Business Analytics Process and organisation, competitive advantages of Business Analytics. Statistical Tools: Statistical Notation, Descriptive Statistical methods, Review of probability distribution and data modelling, sampling and estimation methods overview. **COs-CO1**

UNIT II:

Trendiness and Regression Analysis: Modelling Relationships and Trends in Data, simple Linear Regression. Important Resources, Business Analytics Personnel, Data and models for Business analytics, problem solving, Visualizing and Exploring Data, Business Analytics Technology. **COs-CO2**

UNIT III:

Organization Structures of Business analytics, Team management, Management Issues, Designing Information Policy, Outsourcing, Ensuring Data Quality, Measuring contribution of Business analytics, Managing Changes. Descriptive Analytics, predictive analytics, predicative Modelling, Predictive analytics analysis, Data Mining, Data Mining Methodologies, Prescriptive analytics and its step in the business analytics Process, Prescriptive Modelling, nonlinear Optimization. **COs-CO3**

UNIT IV:

Forecasting Techniques: Qualitative and Judgmental Forecasting, Statistical Forecasting Models, Forecasting Models for Stationary Time Series, Forecasting Models for Time Series with a Linear Trend, Forecasting Time Series with Seasonality, Regression Forecasting with Casual Variables, Selecting Appropriate Forecasting Models. Monte Carlo Simulation and Risk Analysis: Monte CarleSimulation Using Analytic Solver Platform, New-Product Development Model, Newsvendor Model, Overbooking Model, Cash Budget Model. **COs-CO4**

UNIT V:

Decision Analysis: Formulating Decision Problems, Decision Strategies with the without Outcome Probabilities, Decision Trees, The Value of Information, Utility and Decision Making.

Recent Trends in : Embedded and collaborative business intelligence, Visual data recovery, Data Storytelling and Data journalism. **COs-CO5**

Reference:

1. Business analytics Principles, Concepts, and Applications by Marc J. Schniederjans, Dara G. Schniederjans, Christopher M. Starkey, Pearson FTPress.
2. Business Analytics by James Evans, personsEducation.

Course Title: INDUSTRIAL SAFETY	**Course Code: R2438OE01.2**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 03
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Business Analytics, students should have a solid understanding of mechanical and electrical systems, engineering materials,industrial processes and tools.	

Course Objectives:

1. Provide a comprehensive understanding of industrial safety, accident prevention, and legal safety frameworks.
2. Impart the knowledge of maintenance engineering principles and strategies.
3. Educate students on wear and corrosion, their impact, and prevention techniques.
4. Develop skills for systematic fault tracing in various equipment and systems.
5. Equip students with methods and schedules for effective periodic and preventive maintenance.

Course Outcomes:

At the end of the course, students will able to,

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	BT Level
CO1: Explain industrial accidents, safety measures, and legal requirements (Factories Act 1948).	2	1	–	–	–	3	2	L2
CO2: Describe maintenance engineering principles, types of maintenance, and tools used.	2	2	–	–	2	–	–	L2
CO3: Analyze causes of wear and corrosion and select suitable lubrication techniques.	2	3	–	2	2	–	2	L3
CO4: Apply fault tracing techniques and draw decision trees for common equipment faults.	2	3	–	3	3	–	–	L3
CO5: Develop preventive maintenance schedules and programs for electrical and mechanical equipment.	3	3	2	2	2	–	3	L4

SYLLABUS

UNIT I :

Industrial safety: Accident, causes, types, results and control, mechanical and electrical hazards, types, causes and preventive steps/procedure, describe salient points of factories act 1948 for health and safety, wash rooms, drinking water layouts, light, cleanliness, fire, guarding, pressure vessels, etc, Safety color codes. Fire prevention and firefighting, equipment and methods. **COs-CO1**

UNIT II:

Fundamentals of maintenance engineering: Definition and aim of maintenance engineering, Primary and secondary functions and responsibility of maintenance department, Types of maintenance, Types and applications of tools used for maintenance, Maintenance cost & its relation with replacement economy,

Service life of equipment. **COs-CO2**

UNIT III:

Wear and Corrosion and their prevention: Wear- types, causes, effects, wear reduction methods, lubricants-types and applications, Lubrication methods, general sketch, working and applications, i. Screw down grease cup, ii. Pressure grease gun, iii. Splash lubrication, iv. Gravity lubrication, v. Wick feed lubrication vi. Side feed lubrication, vii. Ring lubrication, Definition, principle and factors affecting the corrosion. Types of corrosion, corrosion prevention methods. **COs-CO3**

UNIT IV:

Fault tracing: Fault tracing-concept and importance, decision treeconcept, need and applications, sequence of fault finding activities, show as decision tree, draw decision tree for problems in machine tools, hydraulic, pneumatic,automotive, thermal and electrical equipment‟s like, I. Any one machine tool, ii. Pump iii. Air compressor, iv. Internal combustion engine,v. Boiler,vi .Electrical motors, Types of faults in machine tools and their general causes. **COs-CO4**

UNIT V:

Periodic and preventive maintenance: Periodic inspection-concept and need, degreasing, cleaning and repairing schemes, overhauling of mechanical components, overhauling of electrical motor, common troubles and remedies of electric motor, repair complexities and its use, definition, need, steps and advantages of preventive maintenance. Steps/procedure for periodic and preventive maintenance of: I. Machine tools, ii. Pumps, iii.Air compressors, iv. Diesel generating (DG) sets, Program and schedule of preventive maintenance of mechanical and electrical equipment, advantages of preventive maintenance. Repair cycle concept andimportance. **COs-CO5**

Reference:

1. Maintenance Engineering Handbook, Higgins & Morrow, Da InformationServices.
2. Maintenance Engineering, H. P. Garg, S. Chand andCompany.
3. Pump-hydraulic Compressors, Audels, McgrewHillPublication.
4. Foundation Engineering Handbook, Winterkorn, Hans, Chapman &HallLondon

Course Title: OPERATIONS RESEARCH	**Course Code: R2438OE01.3**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 03
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in Operations Research, students should have a solid understanding of mathematics (algebra, calculus),Matrix operations, linear equations, probability, statistics, Logical reasoning and analytical skills.	

Course Objectives:

1. Introduce mathematical modeling techniques used in decision making.
2. Teach various optimization techniques including linear, nonlinear, and dynamic programming.
3. Equip students with skills to solve real-life problems using simplex, duality, sensitivity analysis, and simulation.
4. Explain scheduling, sequencing, and inventory models.
5. Enable students to apply game theory, network flow, and probabilistic models for effective planning and control.

Course Outcomes:

At the end of the course, students will able to,

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	BT Level
CO1: Formulate and solve linear programming problems using graphical and simplex methods.	3	3	–	2	2		L3
CO2: Apply duality, revised simplex, and sensitivity analysis to evaluate impacts of parameter changes.	3	3	–	2	2		L4
CO3: Solve nonlinear programming and network models like minimum cost and maximum flow problems.	3	3	–	3	2		L4
CO4: Apply scheduling, sequencing, and inventory models (deterministic and probabilistic) to optimize resource usage.	2	3	–	3	3		L3
CO5: Apply game theory, dynamic programming, and simulation techniques to solve competitive and stochastic problems.	3	3	–	3	3		L4

SYLLABUS

UNIT I :
Optimization Techniques, Model Formulation, models, General L.R Formulation, Simplex Techniques, Sensitivity Analysis, Inventory Control Models **COs-CO1**

UNIT II
Formulation of a LPP - Graphical solution revised simplex method - duality theory - dual simplex method - sensitivity analysis - parametric programming. **COs-CO2**

UNIT III:
Nonlinear programming problem - Kuhn-Tucker conditions min cost flow problem - max flow problem - CPM/PERT. **COs-CO3**

UNIT IV:
Scheduling and sequencing - single server and multiple server models - deterministic inventory models - Probabilistic inventory control models - Geometric Programming. **COs-CO4**

UNIT V:
Competitive Models, Single and Multi-channel Problems, Sequencing Models, Dynamic Programming, Flow in Networks, Elementary Graph Theory, Game Theory Simulation **COs-CO5**

REFERENCES:

1. H.A. Taha, Operations Research, An Introduction, PHI, 2008
2. H.M. Wagner, Principles of Operations Research, PHI, Delhi, 1982.
3. J.C. Pant, Introduction to Optimisation: Operations Research, Jain Brothers, Delhi, 2008
4. Hitler Libermann Operations Research: McGraw Hill Pub. 2009
5. Pannerselvam, Operations Research: Prentice Hall of India 2010
6. Harvey M Wagner, Principles of Operations Research: Prentice Hall of India 2010

Course Title: COST MANAGEMENT OF ENGINEERING PROJECTS	**Course Code: R2438OE01.4**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 03
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in cost management of engineering projects , students should have a solid understanding of accounting and cost principles, Familiarity with project lifecycle concepts, decision-making tools and mathematical fundamentals	

Course Objectives:

1. To introduce strategic cost management concepts and tools used in decision-making.
2. To develop the ability to plan, execute, and control technical and non-technical aspects of projects.
3. To apply cost behavior, variance analysis, and planning techniques in managerial decisions.
4. To integrate modern tools like ERP, TQM, and benchmarking into cost management systems.
5. To utilize quantitative and optimization techniques in budgeting, pricing, and project evaluation.

Course Outcomes:

At the end of the course, students will able to,

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO10	PSO1	BT Level
CO1: Explain cost concepts, relevant costing, and use of data in decision-making.	3	3	–	2	2	–	–	–	–	–	L2
CO2: Describe stages of project planning and execution with documentation and legal clearances.	3	3	–	2	2	2	–	–	–	–	L2
CO3: Apply cost control, scheduling tools, and teamwork concepts in project execution and commissioning.	2	3	3	3	3	3	2	–	2	–	L3
CO4: Analyze cost behaviors, profit planning, pricing strategies, and variance analysis for business decisions.	3	3	2	3	2	–	–	–	–	–	L4
CO5: Evaluate advanced cost management methods like ABC, TQM, Benchmarking, and apply quantitative models for cost optimization.	3	3	3	3	3	3	–	2	–	–	L5

SYLLABUS

UNIT-I

Introduction and Overview of the Strategic Cost Management Process, Cost concepts in decision-making; Relevant cost, Differential cost, Incremental cost and Opportunity cost. Objectives of a Costing System;

Inventory valuation; Creation of a Database for operational control; Provision of data for Decision-Making. **COs-CO1**

UNIT-II

Project: meaning, Different types, why to manage, cost overruns centres, various stages of project execution: conception to commissioning. Project execution as conglomeration of technical and non-technical activities.Detailed Engineering activities. Pre project execution main clearances and documents.

COs-CO2

UNIT-III

Project team: Role of each member. Importance Project site: Data required with significance. Project contracts.Types and contents. Project execution Project cost control. Bar charts and Network diagram. Project commissioning: mechanical and process. **COs-CO3**

UNIT-IV

Cost Behavior and Profit Planning Marginal Costing; Distinction between Marginal Costing and Absorption Costing; Break-even Analysis, Cost-Volume-Profit Analysis. Various decision-making problems. Standard costing and Variance Analysis. Pricing strategies: Pareto Analysis. Target costing, Life Cycle Costing. Costing of service sector.Just-in-time approach, Material Requirement Planning, Enterprise Resource Planning. **COs-CO4**

UNIT-V

Total Quality Management and Theory of constraints.Activity-Based Cost Management, Bench Marking; Balanced Score Card and Value- Chain Analysis.Budgetary Control; Flexible Budgets;Performance budgets; Zero-based budgets.Measurement of Divisional profitability pricing decisions including transfer pricing. Quantitative techniques for cost management, Linear Programming, PERT/CPM, Transportation problems, Assignment problems, Simulation, Learning Curve Theory. **COs-CO5**

REFERENCES:

1. Cost Accounting A Managerial Emphasis, Prentice Hall of India, New Delhi
2. Charles T. Horngren and George Foster, Advanced Management Accounting
3. Robert S Kaplan Anthony A. Alkinson, Management & Cost Accounting
4. Ashish K. Bhattacharya, Principles & Practices of Cost Accounting A. H. Wheeler publisher
5. N.D. Vohra, Quantitative Techniques in Management, Tata McGraw Hill Book Co. Ltd.

Course Title: COMPOSITE MATERIALS	**Course Code: R2438OE01.5**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 03
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in composite materials, students should have a solid understanding of materials science and mechanical properties of engineering materials and Familiarity with conventional manufacturing processes.	

Course Objectives:

1. To understand the fundamentals, types, and benefits of composite materials.
2. To learn the behavior and application of various reinforcements and matrices.
3. To explore manufacturing techniques for metal, ceramic, carbon, and polymer matrix composites.
4. To analyze the mechanical behavior and performance of composite structures.
5. To apply strength and failure criteria for design of composite laminates.

Course Outcomes:

At the end of the course, students will able to,

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PO11	BT Level
CO1: Explain the classification, characteristics, and advantages of composites and reinforcement effects on performance.	3	3	–	2	2	–	L2
CO2: Describe the types, properties, and preparation techniques of various reinforcements and evaluate their mechanical behavior.	3	3	–	3	–	–	L4
CO3: Explain the manufacturing methods for metal, ceramic, and carbon–carbon composites and their applications.	3	3	2	2	3	–	L2
CO4: Illustrate and compare manufacturing processes of polymer matrix composites and evaluate their suitability in various applications.	3	3	2	3	2	–	L4
CO5: Apply strength and failure criteria for composite laminates and analyze stress-strain behavior under loading.	3	3	3	3	3	–	L5

SYLLABUS

UNIT–I:

INTRODUCTION: Definition – Classification and characteristics of Composite materials. Advantages and application of composites. Functional requirements of reinforcement and matrix.Effect of reinforcement (size, shape, distribution, volume fraction) on overall composite performance. **COs-CO1**

UNIT – II:

REINFORCEMENTS: Preparation-layup, curing, properties and applications of glass fibers, carbon

fibers, Kevlar fibers and Boron fibers. Properties and applications of whiskers, particle reinforcements. Mechanical Behavior of composites: Rule of mixtures, Inverse rule of mixtures. Isostrain and Isostress conditions. **COs-CO2**

UNIT – III:

Manufacturing of Metal Matrix Composites: Casting – Solid State diffusion technique, Cladding – Hot isostaticpressing. Properties and applications. Manufacturing of Ceramic Matrix Composites: Liquid Metal Infiltration – Liquid phase sintering. Manufacturing of Carbon – Carbon composites: Knitting, Braiding, Weaving. Properties and applications. **COs-CO3**

UNIT–IV:

Manufacturing of Polymer Matrix Composites: Preparation of Moulding compounds and prepregs – hand layup method – Autoclave method – Filament winding method – Compression moulding – Reaction injection moulding. Properties and applications. **COs-CO4**

UNIT – V:

Strength: Laminar Failure Criteria-strength ratio, maximum stress criteria, maximum strain criteria, interacting failure criteria, hygrothermal failure. Laminate first play failure-insight strength; Laminate strength-ply discount truncated maximum strain criterion; strength design using caplet plots; stress concentrations. **COs-CO5**

TEXT BOOKS:

1. Material Science and Technology – Vol 13 – Composites by R.W.Cahn – VCH, West Germany.
2. Materials Science and Engineering, An introduction. WD Callister, Jr., Adapted by R. Balasubramaniam, John Wiley & Sons, NY, Indian edition,2007.

REFERENCES:

1. Hand Book of CompositeMaterials-ed-Lubin.
2. Composite Materials – K.K.Chawla.
3. Composite Materials Science and Applications – Deborah D.L.Chung.
4. Composite Materials Design and Applications – Danial Gay, Suong V. Hoa, and Stephen W. Tasi.

Course Title: WASTE TO ENERGY	**Course Code: R2438OE01.6**
Teaching Scheme (L:T:P): 3:0:0	**Credits:** 03
Type of Course: Lecture	
Continuous Internal Evaluation: 30 Marks	**Semester End Exam:** 70 Marks
Pre requisites: To succeed in waste to energy, students should have a solid understanding of thermodynamics, heat transfer, and environmental science,Awareness of renewable energy systems and energy conversion technologies.	

Course Objectives:

1. To classify different types of waste and identify suitable conversion technologies.
2. To study biomass conversion methods like pyrolysis, gasification, and combustion.
3. To understand the construction and working of various biomass and waste-to-energy systems.
4. To analyze energy yield, performance, and applications of waste-to-energy technologies.
5. To explore the status, design, and applications of biogas and biofuel systems in India.

Course Outcomes:

At the end of the course, students will able to,

Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	BT Level
CO1: Classify waste resources and describe different energy conversion devices like incinerators, gasifiers, and digestors.	3	3	–	2	2	–	L2
CO2: Explain types of pyrolysis, methods for charcoal production, and applications of pyrolytic oils and gases.	3	2	–	2	2	–	L2
CO3: Analyze biomass gasifiers, their design and operation, and assess performance in thermal and electrical applications.	3	3	3	3	3	–	L4
CO4: Illustrate and compare combustion technologies like biomass stoves, chullahs, and fluidized bed combustors.	3	3	2	3	2	–	L4
CO5: Evaluate biogas systems, conversion technologies, and biofuel production processes with reference to India's biomass energy programme.	3	3	3	3	3	–	L5

UNIT-I

Introduction to Energy from Waste: Classification of waste as fuel – Agro based, Forest residue, Industrial waste - MSW – Conversion devices – Incinerators, gasifiers, digestors. **COs-CO1**

UNIT-II:

Biomass Pyrolysis: Pyrolysis – Types, slow fast – Manufacture of charcoal – Methods - Yields and application – Manufacture of pyrolytic oils and gases, yields and applications. **COs-CO2**

UNIT-III:

Biomass Gasification: Gasifiers – Fixed bed system – Downdraft and updraft gasifiers – Fluidized bed gasifiers – Design, construction and operation – Gasifier burner arrangement for thermal heating – Gasifier engine arrangement and electrical power – Equilibrium and kinetic consideration in gasifier operation. **COs-CO3**

UNIT-IV:

Biomass Combustion: Biomass stoves – Improved chullahs, types, some exotic designs, Fixed bed combustors, Types, inclined grate combustors, Fluidized bed combustors, Design, construction and operation - Operation of all the above biomass combustors. **COs-CO4**

UNIT-V:

Biogas: Properties of biogas (Calorific value and composition) - Biogas plant technology and status - Bio energy system - Design and constructional features - Biomass resources and their classification - Biomass conversion processes - Thermo chemical conversion - Direct combustion - biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - Types of biogas Plants – Applications - Alcohol production from biomass - Bio diesel production - Urban waste to energy conversion - Biomass energy programme in India. **COs-CO5**

REFERENCES:

1. Non Conventional Energy, Desai, Ashok V., Wiley Eastern Ltd., 1990.
2. Biogas Technology - A Practical Hand Book - Khandelwal, K. C. and Mahdi, S. S., Vol. I & II, Tata McGraw Hill Publishing Co. Ltd., 1983.
3. Food, Feed and Fuel from Biomass, Challal, D. S., IBH Publishing Co. Pvt. Ltd., 1991.
4. Biomass Conversion and Technology, C. Y. WereKo-Brobby and E. B. Hagan, John Wiley & Sons, 1996.

Course Title: DISSERTATION PHASE – I	**Course Code: R2438DP01**
Teaching Scheme (L:T:P): 0:0: 20	**Credits:** 10
Type of Course: Practicals	

The student should identify a dissertation/project topic relevant to:

- Social needs of society
- Value addition to existing facilities in the institute
- Industry requirements
- National development priorities
- Research and development in the relevant domain

The student is expected to complete the following during Phase–I:

- Literature Survey and Problem Definition
- Motivation and Objectives of the Study
- Preliminary Design / Feasibility Study / Modular Approaches
- Initial Implementation and Proof of Concept (if applicable)
- Regular documentation and presentation of progress

Guidelines for Dissertation Phase – I in M. Tech (DECS):

- As per the AICTE directives, the dissertation is a yearlong activity, to be carried out and evaluated in two phases i.e. Phase – I: July to December and Phase – II: January to June.
- The dissertation may be carried out preferably in-house i.e. department‟s laboratories and centers OR in industry allotted through department‟s T & P coordinator.
- After multiple interactions with guide and based on comprehensive literature survey, the student shall identify the domain and define dissertation objectives. The referred literature should preferably include IEEE/IET/IETE/Springer/Science Direct/ACM journals in the areas of Computing and Processing (Hardware and Software), Circuits-Devices and Systems, Communication-Networking and Security, Robotics and Control Systems, Signal Processing and Analysis and any other related domain. In case of Industry sponsored projects, the relevant application notes, while papers, product catalogues should be referred and reported.
- Student is expected to detail out specifications, methodology, resources required, critical issues involved in design and implementation and phase wise work distribution, and submit the proposal within a month from the date of registration.

- Phase – I deliverables: A document report comprising of summary of literature survey, detailed objectives, project specifications, paper and/or computer aided design, proof of concept/functionality, part results, A record of continuous progress.
- Phase – I evaluation: A committee comprising of guides of respective specialization shall assess the progress/performance of the student based on report, presentation and Q &A. In case of unsatisfactory performance, committee may recommend repeating the Phase-I work.

Dr. E. Govinda, HOD

BoS Chairman, Dept of ECE

II YEAR-IISEMESTER

Course Title: DISSERTATION PHASE – II	**Course Code: R2438DP02**
Teaching Scheme (L:T:P): 0:0: 32	**Credits:** 16
Type of Course: Practicals	

The dissertation work from Phase–I is extended into full implementation and testing.

Students are expected to:

- Finalize design and complete development/testing of the proposed system
- Analyze, interpret, and validate results
- Focus on innovation, relevance, and practical applicability
- Prepare and submit a comprehensive dissertation report

The dissertation may involve:

- Experimental verification or proof of concept
- Design, fabrication, and testing of electronic/communication systems
- Software and/or hardware prototypes.

Guidelines for Dissertation Phase – II in M. Tech (DECS):

- During phase – II, student is expected to exert on design, development and testing of the proposed work as per the schedule. Accomplished results/contributions/innovations should be published in terms of research papers in reputed journals and reviewed focused conferences OR IP/Patents.
- Phase – II deliverables: A dissertation report as per the specified format, developed system in the form of hardware and/or software, a record of continuous progress.
- Phase – II evaluation: Guide along with appointed external examiner shall assess the progress/performance of the student based on report, presentation and Q &A. In case of unsatisfactory performance, committee may recommend for extension or repeating the work.

Dr. E. Govinda, HOD

BoS Chairman, Dept of ECE